PUBLIC WORKS

Devoted to the interests of the engineers and technical officials of the cities, counties and states

NOVEMBER, 1937

A. PRESCOTT FOLWELL, Editor — VOL. 68, NO. 11 — W. A. HARDENBERGH, Asso. Editor

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TIMEWASTERS

Solutions:

An unprecedented amount of work, plus a wedding in the organization (no, not mine) threw the TIMEWASTER organization entirely out of whack this month. We hope to dig out to free air pretty soon and get caught up. However, we can announce that the aid for Santa Claus was forthcoming, and that the accurate dimensions for the pencil box were received from several.

The garage door has been a sort of a stopper to most of our co-workers. The ox problem was solved very satisfactorily by quite a few.

The garage door problem involves calculus, of course, and is right complicated. Mr. Bevan, who contributed this, gives as the answer 96.212 cubic feet, and says that the bounding surface is a hypocycloid and cylinder. The pencil box had to be 0.8537 ins. on each side. The answer to the ox problem was 42.

The Ladder Problem:

How far apart must two buildings be so that two ladders, one touching the base of each of the buildings, and leaning against the side of the other building, cross 10 feet above ground. One of the ladders is 20 feet long and the other is 30 feet long. Contributed by Mr. Reichstein, we believe, no name being signed to the sheet.

Another Flag-Pole Problem:

Gus Sauer, the dissenter from the standard solution about the falling flag pole, came up from Texas last week for a visit with the editor of TIMEWASTERS. In his honor, we spring this one: The old court-house was topped with a flag pole, the total height of the two being 110 feet. A wind blew the flag pole down, it breaking off at such a distance from the top that the point just touched the ground and also touched the edge of the court-house entrance which was 11 feet above ground and 11 feet out from the flag pole. At what point did it break off? It is understood, of course, that the upper end remained attached to the stub of the pole.

These both being tough and troublesome problems, and Christmas coming on, we'll limit ourselves to these two for the month. W. A. H.

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Turn to pages 63-65 for descriptions of helpful booklets and catalogs.

PUBLIC WORKS
City, County and State Engineering and Construction

NOVEMBER, 1937
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Snow Control Equipment and Methods

This material is a continuation of data on snow fighting methods and equipment, the first portion of which appeared in our October issue.

THE Frink 117S is for Chevrolet, International and other light trucks, and is designed for light plowing and patrol work, and especially for snows a little too heavy to be handled efficiently with a blade plow. The 118S is similar, but a foot wider for larger trucks with dual rear tires. The 147S is for the same size trucks as the 118S, but is a foot narrower, is heavier and has a higher moldboard. The 148S is 8 ft. wide, otherwise the same as the 147S. The 158S is still heavier and is designed to handle freshly fallen snow up to 5 ft. deep, or packed and crusted snow up to 3 ft. deep. The 168S is largest and heaviest of all, being designed for the most difficult jobs.

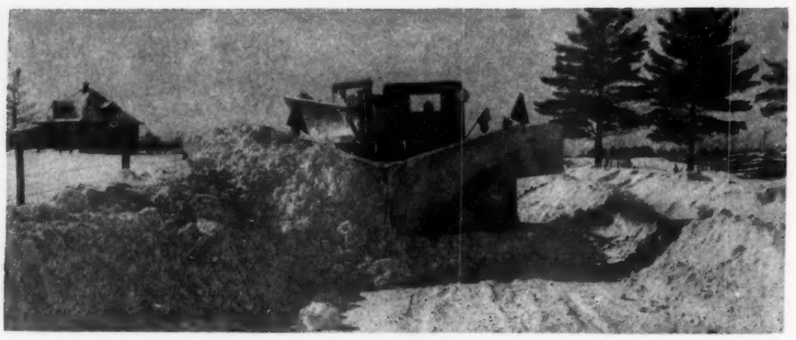
Sargent has a large line of V plows, these including the Sargent-International and the Sargent-Cletrac conversion groups. The conversion groups consist of a bulldozer and a snow plow, which are interchangeable with each other and have a common power unit and hook-up. This saves duplication of power units. When the tractor is equipped for snow plow use, the change to a bulldozer for summer construction can be made without any change in the hydraulic power unit. A tractor equipped for a bulldozer, requires the bolting on of two more valve sections and two more control levers.

Sargent V plows are equipped with convertible moldboards: that is, the upper part of the V moldboard is hinged at the deepest part of the curve. The upper part of the moldboard can be set in any position from straight up to almost flat forward. On fast plowing this keeps the snow off the windshield, and in deep banks permits the snow to "roll" properly.

A "city" type plow, especially designed by Sargent for plowing over manholes, has the V supported 4 inches off the pavement by three fixed height oscillating runners. For cleaning the pavement surface, this can be followed by a one-way trip plow, or a center scraper. This V unit is interchangeable with the "City Patrol," a one-way trip blade.

For Class A (1½-ton) trucks, the 5-V-1 is supplied by Sargent. This has a ground cutting width of 7 ft. 6 ins. and weighs, with underframe, 1750 lbs. For Class B (2-ton and larger, conventional chassis), there are 4 units with hand hydraulic lift and four with power hydraulic lift. The former include the 10-V-1, 10-V-2, 10-V-3 and 10-V-4, cutting 7 ft. 6 ins. to 9 ft., and weighing 1580 to 2800 pounds. The power lift plows are the 30-V-1, 30-V-2, 30-V-3 and 30-V-4, of approximately the same weight and dimensions.

Sargent One-Way Speed Plow patrolling a country road



Allis-Chalmers "K-O" tractor working in Wisconsin

For Class C (all sizes and all makes with projecting frames) trucks, there are four sizes available with hand hydraulic lift, four sizes with type A power hydraulic lift, and four sizes with type B power hydraulic lift. The type A lift is more powerful, and is especially valuable when wings are used.

Parsons Co. V plows are the LV4 and the V-3. Each of these clear a path 8 ft. 6 in. wide, and are 3 ft. 6 in. high at the front. The V-3 is the larger, weighing 1,600 pounds, without attachments, while the LV4 weighs 1,300 pounds. These plows are designed for heavy, fast work and for use with the heavier types of trucks. The Parsons plow illustrated was furnished last year on the following four wheel drive trucks: F. W. D., Oshkosh, Indiana, Coleman, Walters and Hug. This plow is a heavy duty V, with right hand wing, both plow and wing being hydraulically controlled.

This year Parsons is equipping all plows with an improved hand control, or as an alternative an improved type of power hydraulic control.

Galion furnishes V plows, especially for service with their large line of motor graders and maintainers, thus providing additional snow fighting equipment. Because of their power and weight, such graders and maintainers are well adapted to heavy work: also for use with a reversible blade for urban plowing, removing ice, etc.

V-type plows are made by Austin-Western in three sizes, one for 1½ and 2-ton trucks and two for 3-ton trucks. The former weigh 660 pounds and the latter 1200 pounds for the standard and 1010 pounds for the high model, all weights excluding the attachments. For the small truck, the width of cut is 8 ft., the nose height 2 ft. 2 in.; on the larger standard model, width of cut is 9 ft. 1 in. and the nose height 3 ft.; on the high model, width of cut is 8 ft. and nose height 3 ft., but the upward flare of the wings is greater. All models are operated by hand hydraulic controls located in the truck cab. These V plows use the same underframe attachments as the one-way and reversible plows already described.

Three V models are made by Baker for use with trucks, these being designed for light, medium and heavy work. Baker also makes a line of heavy-duty V-type plows for Allis-Chalmers tractors; the 247 plow, designed for the Allis-Chalmers M tractor, weighs 2400 pounds without wings; the 230, for the A-C K and KO tractors weighs 6165 pounds without the wings; the 241 plow, for the A-C L or LO tractors for the heaviest type of plowing, weighs 10,000 pounds without wings. Wings add about 40% to the weight.

Riddell makes a V plow, to work with the Warco 33 motor grader, which weighs 1385 pounds without attachments. Adams also has a V plow designed for the Adams motor graders Nos. 50, 51, 301 and 151, which is slightly larger and heavier, weighing about 2100 pounds.

Good Roads V plows are made for 1½-ton trucks and small wheel tractors (No. 510); for 2½ to 3½-ton trucks (No. 520); for 3 to 4-ton trucks

Case Tractor with Frink V Plow

Parsons V Plow used by Iowa Highway Commission

(No. 560); and for 5-ton and heavier trucks (No. 570); also three additional models that vary slightly from those listed. All have hydraulic lifts.

Leveling Wings

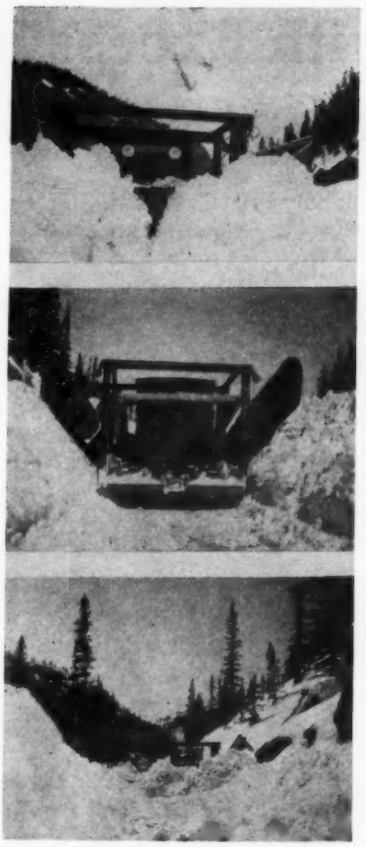
Leveling wings are attached to trucks as adjuncts to snow plows. The wings bevel and trim off the tops of the side banks of snow, carrying this back and spreading it out so as to reduce the tendency to drift. When the snow depth is not too great, they may be lowered to the road surface and used as auxiliary plowing blades, thus widening the cleared way; also for plowing the shoulders where the plow itself cannot well go. Wings have controls so that they can be swung out or in, raised or lowered as desired. A brace holds the wing from the truck body, in working position; but when a solid obstruction is hit, as a curb, culvert wing wall or manhole cover, the wing automatically trips, then returns to its former position.

One wing is usually considered sufficient, as the other side of the highway can be "winged back" on the return trip; but in freshly fallen snow, not too deep, the use of two wings—one on either side—permits clearing a space 12 to 16 feet wide and eliminates the necessity of a return trip.

The best place to mount wings depends somewhat on the type of truck and somewhat on the wing itself, but generally it should be mounted well forward. Frink attaches wings on rear-wheel-drive trucks, just back of the cab; and on four-wheel-drive trucks, to the cab itself. Good Roads recommends rear mounted wings for rear-wheel-drive trucks and front mounted wings for four-wheel-drive trucks.

Sargent recommends front wings because they plow cleaner and do not reduce traction for the truck by permitting snow to fall between the V and the wing, and also states that this arrangement requires less power, piles snow higher and will handle heavier side banks. This firm makes many types of wings, including a tripping wing especially designed for plowing on highways through congested areas where manholes are common.

Wings are furnished by many of the manufacturers of plows. Frink has a very complete variety—fourteen different types, most of which are front-mounted wings, the various sizes having a height at the front ranging from 21 to 24 ins., a height at the rear of 26 to 35 ins., and lengths from 7 to 12 ft. Sargent, Good Roads, Wausau, Bros, American, Ross and Baker also manufacture wings.



Above: Cleveland tractor and Sargent plow opening Wolf Creek Pass, Colo.

Additional information on snow fighting and ice control appears on pages 46 to 51, this issue.

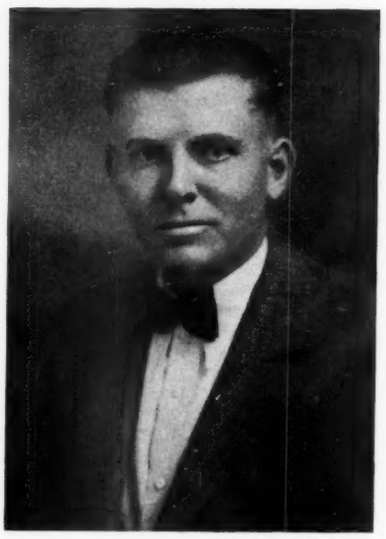
Baker V Plow clearing road

Experiences with Excessively Corroding Sewage Gases at El Centro

By PHILIP W. KNIGHTS
City Engineer of El Centro

THE sewage of El Centro, Calif., possesses characteristics which, fortunately, are unusual if not unique in their intensities. They have caused three deaths and practically destroyed sewers costing more than a quarter of a million dollars.

El Centro is situated about ten miles north of the Mexican border and approximately midway between the east and west boundaries of California; roughly, in the center of what was once known as the Colorado desert but which irrigation has transformed into the Imperial valley. Its elevation is about 50 feet *below* sea level, and it and the entire valley drain northward into Salton Sea, 275 feet below sea level.



Philip W. Knights

The city was incorporated in 1908, with a population of about 500; grew to 3,500 in 1915, and is now about 11,000. A sewer system, with the sewage pumped to a farm three miles away, was begun in 1908. In 1915 the city, jointly with the city of Imperial, four miles north, built a joint outfall sewer 8.5 miles long discharging into New River, with an Imhoff tank about 1,000 feet from the stream, which cost $325,000. The outfall was a single-ring brick sewer 33 inches diameter, except for the 1,000 feet from Imhoff tank to river, which was concrete. It was laid at depths reaching a maximum of 30 feet.

In 1925, when the writer was appointed city engineer of El Centro, there were complaints of a serious odor nuisance along the outfall, which he and the sanitary engineer of the State Board of Health, R. F. Goudy, investigated. We found that the sewer was badly decayed and disintegrating. Mr. Goudy reported: "Analysis clearly shows that the mineral sulphates of the original water supply were being attacked and hydrogen sulphide gas was being created in sufficient quantities to cause odor over many square miles of adjacent territory." The sulphuric acid resulting from this gas had so seriously attacked the mortar in manholes and sewer that "the structural safety of the manholes and probably the upper portion of the sewer itself has been greatly impaired." This supposition was confirmed the following year, when a section of the concrete pipe collapsed; and in 1931 a section of the brick sewer collapsed and completely stopped the sewer, causing the sewage to overflow the adjoining fields. An extensive investigation showed that the entire line from the outlet back to within about 1.5 miles of El Centro was badly disintegrated, and breaks of varying dimensions continued to occur at intervals. In fact, the entire line, for the most part, was pitted in the upper two-thirds of the section with holes varying from a brick or two to several feet in length. Over some of the larger holes the soil had caved in and in a number of places, particularly under irrigated fields, underground caverns up to 30 feet in diameter had been formed, with only a thin roof of soil remaining over the apex. These holes were repaired as they revealed themselves, but by 1933 it became evident that further repairing would be throwing good money after bad and, with the advice of Koebig & Koebig, consulting engineers, we decided to abandon the entire line and build a new outfall.

Constructing the new outfall in bad ground

There were many interesting features connected with the repair work performed during this period and our efforts to prevent further deterioration. Mr. Goudy had recommended that the sewer be thoroughly cleaned out and that all the manholes and the sewer be washed down once or twice a month with water or sewage, or that the sewage be backed up to fill the entire sewer; and to scrub all manholes and line them with gunite. If this did not prove effective, the only remedy seemed to be "to treat the sewage either with ferrous sulphate to absorb all the hydrogen sulphite formed or to add copper sulphate to kill all the organisms which reduce the mineral sulphates."

Chemical treatment would be very expensive, and the flushing was tried. We devised a hinged wooden plug to fit into the barrel of the sewer which could be inserted through the manholes, causing the sewage to back up until it rose in the manhole several feet above the sewer, when the plug was removed. The entire line was flushed in this way in sections and the flushing was repeated at intervals but this failed to stop the disintegration.

In 1926, when the outfall near the river collapsed, we relaid it with 24 inch vitrified clay pipe with "Petrolastic" joints, by-passing the Imhoff tank, one wall of which was almost eaten through.

When the break in 1931 caused a complete stoppage of the sewer, men with ropes attached and equipped with long poles forced a hole into the sewer just below the break, to receive the sewage and prevent the flooding of the fields; but while this lowered the flood, there was so much mud and silt in the pipe that it still stood about 2 feet above the top of the sewer. By making a hole in the sewer 50 feet below the break and raking out the mud in the sewer the level of the backed-up sewage was lowered but only about a foot.

It was in the effort to remove the remaining deposit that the first loss of life occurred—that of James Shannon, sewer foreman in charge of the work. He knew the sewer, had been in it many times and knew the gases and their effects as a result of considerable experience. He carried a gas mask, but used it only when he believed it necessary. (If you have worn one of these masks when it is 100° and something in the shade and found your nose itching and the sweat running into your eyes, you can readily understand his aversion to using it.) With the idea of flushing the mud out of the sewer by the plug method already described, he entered a manhole (which happened to be along the State highway) using a tripod with block and tackle to lower both men and materials, since the manhole steps had all been eaten away by the gas-formed acid. After remaining in the manhole some twenty minutes he came up for fresh air, saying the gas was getting much stronger, returned for five or six minutes and came up groggy and staggering and sent the truck to the city for some soda solution to stop the smarting of his eyes, leaving with him an experienced helper and an inexperienced Mexican. Shannon permitted no one but himself to go into dangerous places, but consented to let the experienced man go into the manhole to get some tools. He collapsed almost at once and Shannon went down to rescue him, but after tieing him to the tackle rope, himself collapsed. The Mexican and a passing motorist pulled out the assistant, who recovered. But before word could be got to me and Fire Department inhalators placed in an ambulance and driven 6.5 miles to the manhole, 25 or 30 minutes had elapsed and Shannon was dead. Just about a year later, two men, one a consulting engineer from San Francisco, who wished to make a study of the disintegration action, were found dead in a manhole a few miles from the city. They had been warned in San Francisco against entering the sewer without first contacting me and arranging for suitable equipment, but my first knowledge of their proposed visit was a notification by telephone that their bodies had been found. Blood transfusions and inhalators were ineffective in restoring them—they were probably already dead. No one knows just what happened, but apparently one man went down with a rope tied around him, the other tried to pull him up when he passed out but the rope slipped off; then the second man went down to retie the rope and he too was overcome. (A warning from this incident is: Never depend upon a single loop around a body to pull an unconscious man out of any place.)

Following Mr. Shannon's death the city council authorized the purchase of a 2800 gpm gasoline motor-driven pump and 1200 ft. of 8 inch irrigation casing, and a truck on which the entire equipment could be carried. By use of this we could pump sewage around a break, from a manhole above to one below it. In repairing the breaks that were continually occuring, we used sections of sheet metal pipe of slightly smaller diameter than the sewer, which were inserted into the sewer at the break and used as a form around which a reinforced concrete patch was built; as many of the pipe forms being joined together by telescoping as the length of the patch made necessary. Later, when it was known that the sewer would be abandoned, the breaks were repaired with redwood planking. In making these repairs the gases were a serious danger. Manholes were opened above and below the break and blowers installed, but the latter were not always effective; sometimes they set up cross currents that seemed to produce more gas than fresh air. Men working in the break were watched carefully and shifts changed frequently. And naturally the mixture of mud and sewage was a nasty mess. Often openings had to be made into the sewer at 50 ft. intervals for 200 ft. or more for removing the deposit; and usually the surrounding soil was saturated and required extensive sheeting.

The new outfall decided upon carries the sewage from the northeast corner of the town to a pumping plant, which raises it about 16 ft., thence by gravity to New River by the most direct route. A PWA loan and grant for $290,000 was obtained, bonds being voted in October 1935, contracts awarded in February 1936 and the project completed in October 1936. The design was based on an estimated population of 30,000 in 1955. The per capita flow, by actual measurement, averaged 120

"Crater" in an irrigated field formed by collapse of sewer

gpd and the peak flow was 175 gpd. Per capita water consumption, including water for lawns and shrubs, reaches 250 gpd in summer.

The problem of present and future disposal was given much thought by Mr. Koebig, Mr. C. G. Gillespie, State Sanitary Chief, and myself.Our final conclusions were that the present sewage flow could be disposed of by dilution in New River but that it is probable that in the next ten or fifteen years some method of treatment would be required.

The outfall line is twenty-seven inches in diameter, with a total length of seven miles, and has a slope of 1.10 feet per 1000. It leaves the plant at a depth of six feet and reaches New River bank at a depth of twenty-two feet. The probable recurrence of gas and acid attacks meant, of course, that all elements exposed to sewage must be constructed of materials suited to resist these attacks, and every effort was made to design the new outfall and sewage pumping plant as nearly acid-proof as possible. The plans and specifications call for a 27-inch vitrified clay line, with G-K Compound joints; the use of sulphate-resisting cement, and the coating of all inner surfaces of manholes and wet well with Inertol paint. Manhole steps of special alloy were used. It was found, by test, that a cast-iron step containing 0.62% nickel would make an acid resisting alloy.

The pumping plant consists of a dry well and wet well thirty feet deep equipped with one 600 g.p.m., one 900 g.p.m., and one 1200 g.p.m pump, all electrically driven and controlled by a float operating a selector which cuts in the 600 gallon pump at a predetermined level, cuts out the 600 gallon pump and cuts in the 900 at the next level, cuts out the 900 gallon pump and cuts in the 1200 at the next level and, if the sewage in the wet well still rises, both the 600 and 900 gallon pumps are cut back in, and all three pumps operate until the sewage is reduced to the lower level.

There is also installed a 2800 g.p.m. gasoline-driven pump for emergency use (the same pump bought in 1931 with which to by-pass breaks). Also there is a small sump pump to handle floor and under floor drainage.

Most operations of the sewage pumping plant are transmitted by signal wires to the city water plant two miles distant. Through the signal system, lights will indicate which pump is operating and, through the Venturi meter, the rate of flow. An alarm signal operated by a float will sound at the water plant should the sewage in the wet well rise to a point above the three-pump level.

It is the intent that this plant be automatic in its operation and require only daily inspection as to its condition. Any special requirement or emergency will be handled by the water plant crews. Its use lessens the depth of sewer excavation for some six miles by sixteen feet. Also it provides sewage facilities for the western and southwestern expansion of the city which formerly were not available. It can be adapted to serve any future treatment methods.

The actual cost of the project was $283,990.13 as compared to the estimated cost of $290,022.36.

Methane Explosion in Waterworks Reservoir

When referring to safety precautions, miners work on the assumption that anything can happen and it appears that this also can be applied to the waterworks field. On the morning of August 12, an explosion wrecked the concrete storage reservoir at Clinton, Illinois. Apparently for a number of years the wells furnishing the city water supply discharged methane gas with the water but because of the air-lift type of pumping equipment the gas was apparently dispelled at each of the discharge basins at the wells before flowing into the reservoir. The change in type of pumping equipment discharged the water directly in the reservoir, where gas apparently accumulated, and while cutting a hole in the reservoir wall for new piping it is presumed that a spark, possibly occurring by striking a re-inforcing bar, ignited the gaseous mixture. Although considerable damage was done no one was injured.—*From "Over the Spillway," bulletin of the Illinois Dept. of Public Health.*

Construction of Lease of Quarry by Road Contractor

An agreement between a quarry owner and a road contractor that the former would lease the quarry to the latter for 2 cents per ton was conditioned on the road contractor's obtaining the contract for resurfacing a road for which he had bid. It provided the agreement would be void if the contractor did not get the contract. The contractor secured the road contract, but took no stone from the quarry. In an action for breach of the agreement he contended there was no contract. The Kentucky Court of Appeals held, D. L. Walker & Co. v. Lewis, 287 Ky. 107, 101 S. W. (2d.) 685, that the question was, under the evidence, whether it was the understanding between the parties that the quarry owner would later, if requested, give the road contractor a lease on the quarry on a 2 cents per ton royalty basis, leaving it to the option of the contractor to decide whether it would accept the lease and the stone, in which case the jury should find for the road contractor, or whether the agreement was conditioned alone on whether or not the road contractor was awarded the contract to build the road, in which case they should find for the plaintiff quarry owner. The jury found for the plaintiff.

PWA Field Staff Reorganization

Beginning November 1st, the State offices of the P.W.A. were abolished and the field staff reorganized with a set-up of seven regions, as follows:

Region No. 1—New England and the Middle Atlantic States.

Region No. 2—Wisconsin, Michigan, Illinois, Indiana, Ohio, W. Virginia.

Region No. 3—Virginia, Kentucky, Tennessee, N. Carolina, S. Carolina, Georgia, Alabama, Mississippi and Florida.

Region No. 4—Montana, Wyoming, N. Dakota, S. Dakota, Nebraska, Minnesota, Iowa and Missouri.

Region No. 5—Colorado, New Mexico, Kansas, Oklahoma, Arkansas, Louisiana and Texas.

Region No. 6—California, Nevada, Utah and Arizona.

Region No. 7—Washington, Oregon, Idaho.

The Directors of these regions as appointed are as follows: 1—Maurice E. Gilmore. 2—David R. Kennicott. 3—Howard T. Cole. 4—Robert A. Radford. 5—George M. Bull. 6—Kenneth L. Godwin. 7—Claude C. Hockley.

The Engineers are: 1—George P. Stowitts. 2—Forrest M. Logan. 3—Stanley H. Wright. 4—(Not yet appointed). 5—Alexander Allaire. 6—William C. Hammatt. 7—Ross A. Gridley.

These regional staffs take over the administration of nearly 3,000 projects of a total estimated value of approximately $2,000,000,000 still under construction, contract or allotment.

A Subterranean Reservoir at Billings, Montana

By A. L. HEWETT
Superintendent, City Water Department

THE City of Billings, Montana, about 23,000 population, has several suburban districts, well improved and consisting of fine modern homes, which it supplies with domestic water. A large number of these districts are supplied by direct pressure from the city mains, but part of the city lying on the slope of the mountain to the north, although an excellent residence district, is at a higher elevation than the present city control reservoir which lies at the north edge of the city.

A. L. Hewett, Supt. Billings Water Department

Within this area is one district, District No. 25, well built up with modern, highclass suburban residences, covering a territory approximately two and one-half miles long and a mile wide, most of which lies along the slope of the mountain at an elevation above the city reservoir and which therefore cannot be supplied with water by direct pressure from the city. The distribution system in this district was built by an improvement district and paid for by the property lying therein, to which the City Water Department undertook to furnish an adequate supply of domestic water at a pressure sufficient to give satisfactory service.

The northern limits of this district are defined by what is known locally as the "Rimrock"—a vertical ledge of rock outcropping at the upper edge of the slope, which is on an average about 100 feet high, with the top of the ledge standing approximately 300 feet above the city reservoir.

The proper pressure for this district called for a reservoir 200 feet or more above the present city reservoir. This rimrock came at approximately this elevation, and it seemed necessary to build a storage reservoir at the foot of the rimrock, as a reservoir located at the top of the rimrock would give too much pressure.

Intermediate Reservoir

Winter temperatures at Billings fall so low that, in designing a storage reservoir, safeguards must be taken to protect water from freezing when it is stored in a quiescent state. Considering this and the fact that the demands of this district would be such that the water would remain in the reservoir, at least during the night hours, in a quiescent state, it was determined to use adequate means to protect the water stored for this district so that it would not freeze. A solution of the problem was adopted which is rather unique, but answered all of the requirements.

It was decided to build this reservoir by driving a tunnel back into the ledge of rock at its base some 70 feet long and excavating in the solid rock a spherical hole 33 feet in diameter. The reservoir so excavated gives a pressure of 210 feet in the upper part of the district to be supplied and approximately 270 feet pressure along its lower edges. There is a roof of solid rock above the reservoir 55 feet thick and the minimum thickness between reservoir and face of ledge is 54 feet. This would seem to eliminate any chance of freezing during the extreme low temperatures had in the winter months.

The distribution system for the district was connected to the reservoir by carrying one of the mains through the tunnel and into the bottom of the spherical reservoir. After the pipe had been laid in this tunnel, the tunnel was blocked off with a heavy concrete wall, and the inside of the reservoir was sealed with gunite and waterproofed. A check on the leakage of this reservoir shows that the loss of water from it is practically negligible, which is an important consideration.

Airport District

A city airport is located on the mesa at the top of the rimrock less than a quarter of mile north of its edge and at an elevation approximately 80 feet above the top of the ledge. It was thus impossible to supply both Suburban District No. 25 and the airport from the same pressure system, as a proper pressure for the district would not carry water to an elevation that would reach the city airport.

A separate system was built for the airport district, and a standpipe 15 feet in diameter and 55 feet high was built to provide ordinary service, while fire pressure is provided by a direct-pressure pump which would

Subsurface reservoir, viewed from entrance to tunnel

operate only during fires. The water for this airport district is taken from the reservoir just described by sinking a well to it from the top of the rimrock and pumping from it by means of a deep-well pump, which lifts it into the standpipe. The pump head of this pump and the pipe lines are located in a frost-proof pit excavated in the solid rock.

The Pumps

The installation of the two booster pumps for these districts did not justify the water department in using a full-time operator to take care of them and they are arranged for automatic operation, the equipment being checked as occasions require by the regular operator from the city.

The winter temperatures make it necessary to protect these pumps from freezing, and this was accomplished by building each pump in a pit below the ground level, which pit was lined by double aircell building tile, which has effectively eliminated sweating in the pit. The operation of this pump pit in winter temperatures shows that it is entirely safe from freezing.

The system was designed and built under the direction of the writer, with E. H. Dunmire, associated with Black and Veatch of Kansas City, as the designing engineer.

The project was built largely with WPA labor, with the department furnishing the necessary equipment and materials, and the actual cost of the project can not be determined on account of the various agencies contributing toward its construction.

The rates provided for the sale of water in the several districts are based on the cost of procuring the water in the city distribution system of Billings, and adding thereto the additional costs of carrying the water to the successive levels for each of the districts.

Wider Highways for Safety in California

RECORDS of traffic accidents in California show that the percentage of overtaking accidents or sideswiping, is in excess of the approaching type of accident. Evidently more clearance is needed. Experience and observation both confirm the conclusion that a ten-foot traffic lane is no longer adequate for modern highspeed traffic.

The California Division of Highways has adopted a new standard of construction for state highways which provides for an increased width of lane. The present ten-foot lane is to be widened to a basic eleven-foot width, making the two-lane roadway 22 feet wide instead of the previous 20 feet.

A standard of 11-foot width of lane for three-lane highways has also been adopted and these will be designed to provide for future expansion into four-lane divided highways with minimum loss of investment. The multiple lane highway of four lanes or more will be a divided highway providing for two roadways in each direction with a dividing or separating strip between them. The standard of construction adopted for these roads is a 12-foot width of lane for the inside lane adjacent to the dividing strip and an 11-foot width for the outside lane. The inside lane of 12-foot width will provide more freedom for the car traveling in this lane while passing and greater freedom and mobility in case of crowding. The outside lane does not require this additional width since it has a shoulder still available to maneuver upon in case of necessity.

Only a relatively small percentage of California highways will be of the divided type. The majority of the roads will always continue to be two-lane roads since that width will accommodate the traffic requirements based on the volume and character of traffic using them. Planning of the narrower roads now constructed must consider their ultimate development in order to prevent waste of some parts of the pavement.

To conform to this additional width of pavement on the roadway, the width between curbs of structures such as bridges and grade separations is also being increased. The additional width provided is two feet beyond the edge of the pavement lanes.

In other words a bridge on a two-lane highway having a 22-foot width of pavement will be 26 feet wide between curbs and the clearance on a structure on a divided roadway will be 27 feet between curbs for each roadway.

Designs have been and are being developed for this widened pavement and also for the divided type of roadway, both for new construction and for the adaptation of existing pavement to the ultimate design of divided roadway. In these designs provision is made for the full use of existing roadway and pavement and for the progressive development to a greater capacity leading toward the ultimate section, with a minimum loss or waste of what already has been installed.

The designs include three-lane roads using the new standard width of lane. These three-lane roads are being built to make them easily adaptable to future expansion into the divided type. This design consists of building two lanes of permanent pavement separated by an intervening lane of lighter type construction. The middle lane can then be converted into a dividing strip without appreciable loss and will serve in the meantime as a traffic lane for passing until traffic volume requires the increased capacity. This type of construction, characterized by the contrasting color of the separate lane, has a decided controlling effect on the operation of vehicles since it definitely demarks the separate lanes in which they are to travel.

A minimum width of four feet has been adopted for the separation strips on the divided roadway. This width is the least that can provide adequate clearance and safety against hazard for vehicles traveling in opposite direction. It will be applied on many multiple lane roads since it conserves space and can be installed in adapting existing pavement to the divided type with less loss of existing pavement. In many cases, too, it will not require additional width of right of way, which would be expensive especially where considerable improvement of adjacent property has occurred.

This minimum width of separation strip requires some positive means of making it effective. This is accomplished by construction of curbs. A curb will prevent promiscuous use of this central strip but it should not be too high and should have a reasonable amount of slope so that it will not present an additional hazard.

The design of the curb adopted for this purpose is 6 inches in height above the surface of the pavement with a batter of 4 inches in this 6 inch height. The installation of the curb will depend upon the width of the division strip. Where this strip is of sufficient width to permit safe operation of the vehicle, the curb can be omitted. Studies at present indicate that with division strips of 20 feet or more in width curbs will not be necessary.

Laying Cotton Fabric on Nevada Roads

TO DETERMINE the practicability of using cotton fabric as a future road construction material, the Nevada Department of Highways recently completed the installation of this material as a reinforcing surface layer over a three-mile stretch of the Pyramid Lake highway in western Washoe County. The project, carried out with the cooperation of the United States Bureau of Public Roads, was in the nature of an experiment, and the first of its kind to be undertaken in Nevada.

The experiment was limited to four sections approximating one mile each. One section was treated with the fine mesh, lightweight material, another with medium grade, while a third was treated with coarser and heavier material. A fourth contiguous section, of similar length, was marked off and given identical road surface treatment minus the cotton membrane. This fourth section is expected to provide a basis for comparison of results under very similar traffic conditions.

The bituminous wearing surface consisted of the application of emulsified asphalt and crushed rock or gravel screenings, reinforced with cotton membrane, placed upon a compacted oil-treated road surface of uniform grade and cross section.

The existing surface was scarified and reshaped to eliminate all depressions and irregularities. Sufficient water was applied to facilitate compaction, after which the surface was rolled with a power roller.

After the surface was properly shaped a prime coat of asphaltic road material of the slow-curing 1A type was spread over the surface width of twenty feet at the rate of one-quarter to one-third gallon per square yard and allowed to dry. The surface was then swept free of all loose material by using either hand or power brooms.

After the prime coat became thoroughly dried a tack coat of approximately one-eighth gallon of penetration emulsion was applied. Immediately after the tack coat the cotton membrane, which comes in rolls of approximately 500-foot lengths, was spread longitudinally in overlapping strips, covering the full width of the primed surface. Crushed rock or gravel screenings was then spread on the cotton membrane reinforcing material at the rate of approximately twenty pounds per square yard. A second application of penetration emulsion was then made at the rate of one-quarter to three-eighth gallon per square yard. Crushed rock or gravel screenings were im-

Above—Spreading the penetration emulsion on the Pyramid Lake road preliminary to laying the cotton fabric. When the oil has set for a short time, cotton membrane sheets are spread over the surface in 500-foot longitudinal strips with eight-inch overlapping edges.

Below—Three stages in the process of laying cotton membrane. Top, fabric unrolling from the spindle as it is moved forward; center, surface appearance after cotton has been laid; bottom, spreading gravel, later power-rolled, on top of the fabric.

mediately spread at the rate of ten pounds per square yard, and swept lightly with a power broom, after which the surface was rolled with a self-propelled roller.

To facilitate the laying of the cotton membrane the maintenance section of the highway department devised and built, in the Reno shops, a mobile unit light enough to be hauled by two workmen. Upon this, receptacles for spindles were fastened. One cotton roll, being comparatively light in weight, was placed on the spindle and mounted on the rear of the mobile drag unit. This was then drawn forward, the fabric unrolled, and two workers, one on each side, trampled the edges of the fabric into proper alignment. As much as 1,800 feet of the cotton-treated surface was finished in one day. Data and illustrations are furnished through the courtesy of *Nevada Highways and Parks,* official publication of the Nevada Department of Highways.

Cleaning Rapid Sand Filters With SO_2

A METHOD of cleaning filter beds by use of sulphur dioxide (sulphurous acid) has been tested at Baltimore's Montebello filters, under arrangements with James W. Armstrong, engineer of that plant. The tests were made during June 28 to July 2, 1937, inclusive, on one of the 60 rapid sand units which have a capacity of 4 mgd each. The conclusions reached were that "a large rapid sand filter can be cleaned by the use of sulphur dioxide introduced through the underdrains up into the sand and gravel bed, within a few days with a minimum of labor and at comparatively reasonable cost." While the cost was more than had been anticipated, it was thought that "in view of the simplicity of the application, the efficiency derived, with the filter being out of service such a short time, it possesses economical merit compared with the cost of removing the entire bed and cleaning it mechanically."

The water treated on these filters contained in 1936 an average of 0.5 ppm of iron, 3.2 of magnesium, 9.7 of calcium, 5.2 of sulphates, and other minerals: a total of 62.4 ppm dissolved solids. Prior to 1930 manganese coating accumulated on the sand as no attempt was made to remove it from the water; but since then the water has been treated with lime and ferrous sulphate which has precipitated the manganese and kept it a minimum in the applied water, allowing only a slight amount to reach the filter beds. Before this SO_2 treatment the sand in the bed treated had a deep brownish-black color and was sticky enough to be moulded wet, and stained the hands brown when rubbed between them. The gravel had a black, pasty coating about ⅛ in. thick. There was a thin coating of mud or loam on top of the sand bed which in some sections had penetrated several inches into the sand. Several fair-sized mud balls and ridges were prominent. Preceding the SO_2 treatment the filter was given a back-washing of 4½ minutes, during which the water rose unevenly through the sand, indicating some quiet or inactive wash-water outlets or mud ball interference.

The beds are regularly cleaned by backwashing at the rate of 3 cu. ft. per minute per sq. ft. The sand is usually cleaned by injector about every two years at a cost of approximately $50 per filter. The gravel has been dug out and cleaned in a revolving screen once in 16 yrs. at a cost of $400, the filter being out of service two or three weeks. The underdrains have never been cleaned since the plant was built 22 yrs. ago.

After the SO_2 treatment the sand was clean, bright in color. The two bottom layers of largest gravel still showed good-sized areas of partly loosened or semi-dissolved, typical black, pasty coating, but with a longer soaking period or a higher velocity of wash water it is believed this coating would have been eliminated, for it was easily washed off.

Primary interest was in removing the coating on the sand and gravel, which was chiefly iron and manganese. The sand was tested for these both before and after treatment, with the following results: Iron—before treatment, 26.61 lb. per ton; after treatment, 0.08 lb. Manganese—before treatment, 9.94 lb. per ton; after treatment, 1.99 lb.

In using the SO_2 in this test it was added as a liquid in three doses, starting with a weak one (0.20% of the sand voids) to note the action and avoid any corrosive action; following this with 0.63% and finally 0.97%. First lowering the water to the bottom of the gravel, the SO_2 was introduced and water added through the underdrains until the level was above the top of the sand. This was left in 16 to 21½ hrs. and the filter then backwashed three times. The wash water of the third wash after the third application was still a light brown color with some fine floc. The filter was then operated through the rewash for an hour, washed, operated for an hour, washed again (for 7½ min.) operated for an hour, washed for 6½ min., and then put into service.

The approximate cost was $1.56 for sulphur dioxide (1,950 lbs.), $19.26 for wash water (2.435 mg) and $15 for labor; a total of $190.26, or an average of $1.18 per cu. yd.

The test was conducted or witnessed by E. S. Hopkins, principal chemist of the Montebello filters; J. G. Patrick, inventor of the method, of the West Virginia Pulp & Paper Co.; another representative of that company; a representative of the Virginia Smelting Co., which furnished the SO_2; and four representatives of the Freeport Sulphur Co., which is interested in developing a small sulphur burner for making sulphurous acid to be used for the same purpose as the liquid sulphur dioxide.

Filling a Tank With Sludge Gas

The Green Bay, Wis., sewage treatment plant utilizes the gas from its digestion tanks, in connection with which it uses a gas tank—a "Hortonsphere" (a spherical container) 50 ft. in diameter. As sludge gas and air, mixed in certain proportions, is explosive, instead of discharging sludge gas into the air-filled container when putting it into service, exhaust gas from the gas engines was used to fill it, and when the CO_2 had displaced the air, it was in turn displaced by the sludge gas, since the mixture of these two is non-explosive.

Routine Sewer Cleaning Better Than Emergency Cleaning

SEWER cleaning should be a maintenance operation; an ounce of prevention, not a pound of cure. A preventive system of maintenance is always less costly than a curative system of restoring service after failure, for when service fails, the curative measures must be handled as an emergency without proper scheduling of time and equipment.

In the City of Newark, N. J., sewer cleaning is carried on as a routine maintenance operation, and a system of continuous sewer inspection and cleaning has been evolved under the direction of the Superintendent of Sewers.

With 360 miles of sewers to maintain, an inspection crew of six men carry on a regular schedule which insures careful inspection of all sewers at least once a year. Two men working together can check the condition of the smaller pipe sewers by observing the flow and the accumulations of deposits at manholes. On the larger concrete or brick sewers a four-man crew handles the inspection, the inspector walking through the sewer itself with an electric battery hand lamp and carefully inspecting all conditions.

There is always the possibility of danger to men in such sewers, both from toxic gases in some locations, and from lack of oxygen even where no toxic gases are present. In the Newark Department the safety of the men entering the sewers for inspection is safeguarded by providing this crew with a Homelite portable blower, which provides positive ventilation which eliminates hazard from gas or lack of oxygen and enables the inspectors to carry on their work according to a regular schedule without delays, danger or discomfort.

The method used is as follows:

Two adjacent manholes are opened and the blower set up to force fresh air into one of these manholes. This air blows through the section of sewer between the manholes clearing all gases out through the other open manhole, and providing a constant flow of fresh air in this section of sewer. It is then safe for the inspector to enter and walk through this section. The blower unit and gasoline engine weigh only 70 pounds, and are easily moved as the inspection progresses.

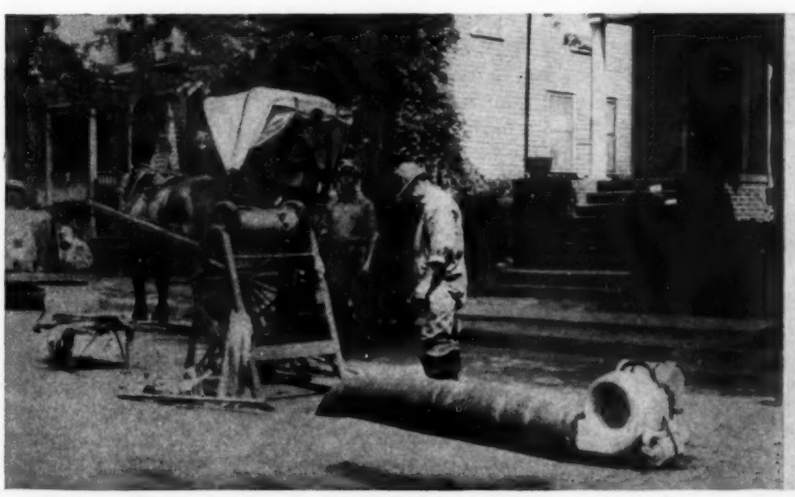
From the inspectors' reports, a schedule is made up for the cleaning crews so that they may go from one location to the next without lost time and with the shortest routing from job to job.

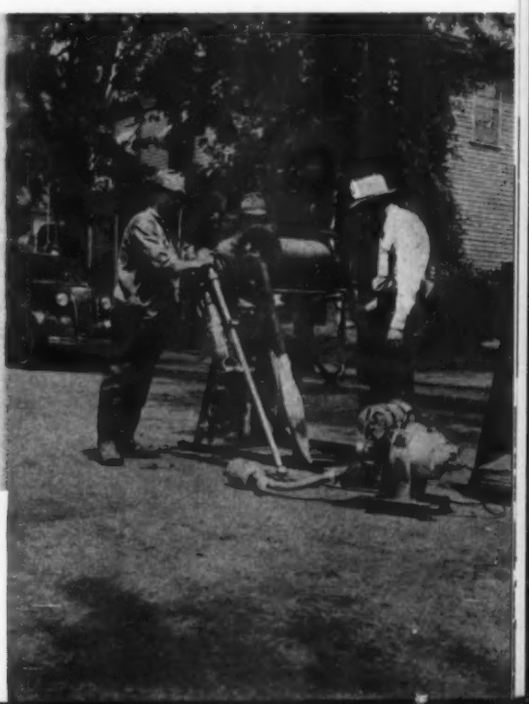
The smaller sizes of sewers are cleaned by dragging a swab through them. These swabs are of a type designed by the Newark Sewer Department and are made up in their own shops in the different diameters required for different sized sewers. The swabs consist of a bole of wire wound on a steel bar core. Holes are drilled through the bar and several bolts or pins placed through as anchors to hold the outside part of the swab. On this core is wound discarded wire of all kinds (old bed springs, fence wire, hay wire) until a bobbin shaped bole of the proper size is formed.

For the cleaning operation a windlass is set up at each of two adjoining manholes. Then with sewer rods, the cable from the lower windless is brought through the pipe. This cable is then attached to one end of the swab, and the cable from the upper windlass attached to the other end of the swab. The swab is then pulled through the sewer from the higher to the lower end. A hose is attached to a nearby hydrant and water turned into the upper manhole to flush after the swab.

To speed up the operation of drawing the swab through and to minimize the labor, a power winch may be used to operate the windlass, although the work is usually done by hand. The driving unit which is shown turning the windlass in the illustrations is powered by a small portable electric drill. Electricity is supplied by a portable generator, which may also be used to supply electricity for light on extension cables for repair work in the sewers. (The Newark Department is not equipped with this unit, the accompanying pictures being taken at a demonstration of a Homelite unit on this work.)

After the swab has been pulled through to the lower manhole, it is lifted out of the way and dirt and roots





Above—Blower removed from manhole, windlass set up for cleaning. Right—Power-operated windlass

that have been brought down are removed from the manhole to a dump truck. Roots up to 72 feet in length have been pulled from sewer pipes with these swabs.

The cleaning crew for the large sewers consists of seven men, including the driver of the dump truck. These sewers are cleaned by sending men down into the sewer to shovel dirt into a wooden pail, carry the pail to the manhole and then hoist it to the surface. Here again the portable blower is used to insure the safety and comfort of the men. In the vicinity of tanneries, chemical works, and laundries, such a blower is particularly needed to clear out the fumes and supply fresh air. The department had experience, some years ago, with men being overcome by gas in sewers, but fortunately without any fatalities. Since equipping both the inspection and cleaning crews with blowers for ventilation, however, there have been no accidents of this type.

Records kept for several years show that an average of three cubic yards of dirt per working day is removed from the Newark sewers. As a result of their regular routine of inspection and cleaning, no great accumulations are ever present in even the largest sewers; the sewers are kept clean—not cleaned after trouble has developed; and it is found to pay in actual cost of maintenance, as well as in better service provided.

Rapid Method for Sampling Bituminous Surfacings

By I. HVIDBERG

EXAMINATION of samples from finished bituminous surfacings usually comprises determination of the bitumen content, the void content, and the grading of the stone. The work of extracting the binder and separating fine mineral matter is troublesome, and the calculation of the void content from five experimental results, namely, content of bitumen and stone, and specific gravities of these constituents, and the original density of the specimen, is unsatisfactory. In a method described by Nellensteyn and Loman the voids are determined without first finding the bitumen and stone contents.

At the Danish Road Laboratory, the author has used a method of estimating the bitumen content which avoids the extraction process. A combination of the two methods is now described, whereby voids and bitumen content can both be determined in the one apparatus, on the same test specimen. The apparatus consists of a glass bottle with a neck having a minimum internal diameter of 40 mm. In the neck is fitted a glass stopper carrying a glass tube about 10 cm. long and about 15 mm. in inside diameter. The top of the tube is in turn closed by a glass stopper. Midway up the glass tube is a 1,000-c.cm. mark; on each side of the mark are graduations of 0.5 c.cm.

A piece of the surfacing weighing about 800 g. is taken and its density determined in the usual fashion. The sample is placed in a temperature of about 160° C. for 15 min. and then cut into small pieces, which are placed in the apparatus and weighed. The bottle is filled with carbon disulphide to the bottom of the neck, and the stoppered apparatus is then agitated mechanically at the rate of 2 to 3 inversions per min. After 20 min. agitation the apparatus is filled with carbon disulphide to the middle of the glass tube, when it is agitated for a further 5 min.

Apparatus and contents are next weighed and left for 20 min. in water thermostat at 20° C., whereupon the volume of the contents is read. The specific weight of the material, and hence the void content of the specimen, can now be calculated from the weight of the test-piece and specific gravity of the carbon disulphide used. Two 25-c.cm. samples of the liquid are withdrawn and each is evaporated in a tared nickel dish. The bitumen obtained is weighed, redissolved in carbon disulphide, transferred to quartz crucibles and ashed. From the mean figure for the ash-free bitumen the total bitumen content of the test-piece is calculated.

Immediately the two 25-c.cm. samples have been withdrawn, the remainder of the solution in the apparatus is poured through a sieve basket, into which the stone is then washed with carbon disulphide. A mesh having openings of 0.075 mm. is used (A.S.T.M. sieve No. 200 or DIN sieve No. 80). The sieve basket is placed in a simple extraction apparatus, consisting of a copper cylinder with reflux condenser. The bitumen can be completely extracted from the aggregate in 10 min.; some of the stone smaller than 0.075 mm. is washed away with the bitumen. The bitumen-free stone from the sieve basket is dried and weighed.

The weight of the total content of stone in the test-piece is the difference between the total weight of the test-piece and the weight of the bitumen found. Hence, the weight of stone finer than 0.075 mm. (filler) that was lost during extraction in the sieve basket is obtainable by subtracting the weight of stone retained in the sieve basket from the weight of the total stone in the test-piece. When the sieve analysis of the aggregate is made the amount of filler found is corrected accordingly.

A complete investigation according to the method described can normally be carried out in 3½ hrs., and no high degree of skill is required. The method is therefore particularly suitable for control analyses in connection with construction. It has been used successfully on coarse asphaltic concrete, Topeka, sand carpets, mastic asphalt, and also for surfacings in which the bitumen is mainly from natural asphalt, e.g., Boeton asphalt. A modified procedure is available to meet cases where the surfacing contains large quantities of very fine, calcareous filler. (From *Bitumen*, 1936, 6 (8). Road Abstracts).

Municipal Debt Limit Not Affected by Water Board Finances

The Alabama Supreme Court holds, Smith v. Waterworks Board of City of Cullman, 175 So. 380, that a municipality may provide and secure an ample water supple and administer the same by appropriate works and ways in its distribution to the people. The waterworks board of a city in Alabama proposed to incorporate under a state statute approved March 2, 1937. This act provides that no city shall be liable for any debt created by such a corporation, nor shall such debt be construed to be an indebtedness of such city. The waterworks board proposed to incur the necessary liability in constructing or acquiring a sufficient water supply for the city, and to issue bonds secured by the corporation's mortgage, for such new and additional utility and facilities for the efficient operation of the city's waterworks system. It is held that the proposed corporation, the issuance of its mortgage and evidence of debt, or the pledge of the income from the sale and delivery of water, did not create a debt or indebtedness of the city within the constitutional debt limitation, and did not offend any principle of organic law.

Concreting Methods at Low Temperatures

IN THE October issue we published an abstract of a discussion of the economics of concreting at low temperatures prepared by the Lone Star Cement Corporation. Following is a summary of successful winter job practices as recommended by them:

1. *Use a good mix:* Follow sound concrete practice; use no more water than required by placing conditions. Lean, wet mixes gain strength more slowly, and hence are exposed to greater risk of freezing.

2. *Heated mixing water:* A 5° rise in temperature of mixing water produces a rise of approximately 1° in concrete temperature. Thus, if concrete temperature is to be raised 20°, without heating aggregates, water temperature should be raised 100°.

Water may be heated by exhaust steam released at the bottom of the tank, by steam coils, or by direct-fired boilers. It pays to have more than enough hot water; only a large reservoir can deliver water at uniform temperature.

A low-pressure boiler of ample size (mounted on skids if the mixer is moving), discharging into the measuring tank of the mixer, is desirable. Under severe conditions, it pays to protect the mixer tank.

Excessive water temperatures should be avoided; 150° is a good working limit—never exceed 180°.

If water is heated above 150°, put water and aggregates into the mixer first. Then, after the drum has revolved a few times, add the cement. In this way, setting up of cement in the mixer will be avoided.

3. *Heated aggregates:* Aggregates should be heated to between 60° and 70°; dry heat and excessive temperatures should be avoided. The soundest method is to store the aggregate in compact piles, underlaid with perforated low-pressure steam pipes. Given sufficient time, the exhaust steam will raise aggregate temperature uniformly and drive out all frost. Heat all parts of the pile thoroughly; under severe conditions, cover stock piles.

Be sure aggregates are fully heated when withdrawn from stock piles—systematic handling will prevent use of cold materials and minimize heat protection.

4. *Thorough mixing:* It pays to mix thoroughly; additional mixing permits the use of less water for a given workability, and that means increased concrete strengths.

5. *Prompt placing:* Concrete should be placed in forms at a temperature that will allow for heat losses before protection is applied, so that the concrete will always be maintained at 70° minimum temperature. Transportation from mixer to work should be studied. Move the concrete no further than necessary—avoid delays—guard against heat loss en route. Deposit concrete as near to final resting place as possible.

Spread, compact and finish concrete promptly—*then apply protection immediately.* Early strengths depend upon the speed with which concrete is protected—heat losses are highest during the first hour after placing.

6. *Heat of hydration:* All concrete generates heat, due to the hardening action of the cement; some cements generate this heat rapidly, others slowly.

This heat, if held in the concrete, greatly assists hardening. As much of its heat of hydration develops at early periods, prompt covering will retain this heat as well as that contained in mixing water and aggregates, and advance the hardening process.

7. *Protection:* Protection against heat losses should be adequate to maintain the desired concrete temperature at all points in the structure and for the full time required.

Methods vary with type of structure and exposure. Wet burlap, heavy beds of straw—plus canvas coverings in cold, windy weather—are used effectively to protect highway pavements and even mass structures.

Canvas enclosures containing heating apparatus, such as perforated steam pipes or salamanders, are used for bridges, buildings and similar structures. Well-made forms help to provide some insulation against heat loss, but in cold weather must be supplemented as indicated above.

Care should be exercised to protect exposed portions of small or moderate mass and exterior vertical surfaces. Pilasters, especially at corners, lintels, buttresses and other exposed members, require extra protection and their own sources of heat in freezing weather.

Don't skimp on heat. Remember, adequate temperatures maintained for a full day are better than inadequate temperatures for several days. Guard against temperature drops—the low point before dawn and the unexpected change in weather.

Do not suddenly expose hardened concrete to low temperatures; in extremely cold weather, allow concrete temperature to decrease slowly, until it is approximately the same as atmospheric temperature, before protection is removed. In extremely cold weather, this may mean 2 or 3 days of tapering off, depending upon the mass of the structure.

8. *Curing:* Concrete has to be kept moist in order to cure—in Winter as well as Summer. If heat is supplied by wet steam, sufficient curing moisture is usually available. If dry heat is used (salamanders, etc.), be careful to avoid drying out. Dried-out concrete will not gain in strength as it should. If air is dry, water should be applied to the concrete.

9. *Chemicals or accelerators:* Salts to lower the freezing point and chemicals designed to raise temperatures are not recommended. Calcium chloride can be

Winter concreting inside of canvas protection

used to increase rate of hardening, but should not exceed 2% by weight of the cement.

10. *Don't take chances:* It pays to be on the safe side; don't take chances simply because you may know of successful concreting in cold weather without proper protection. It is true that frozen concrete has hardened after thawing; but that's taking chances, which may lead to expensive repairs.

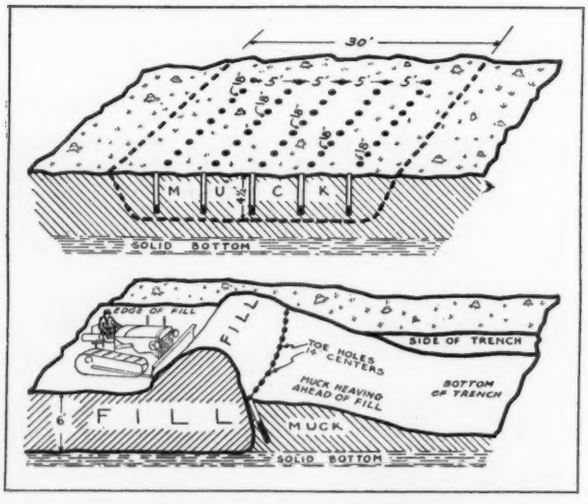
The additional expense necessary to make certain that cold weather does not affect the strength of the concrete is so small that it doesn't pay to neglect the simple precautionary measures.

Blasting for Road Fill on Muck Land

DURING the past few years the use of explosives for settling fill in mucky or swampy land has become more or less common, but soil conditions, depths of fill, etc., vary widely and call for considerable variations in practice to meet the conditions of each case most effectively. In a fill recently made at Laurel, Miss., the contractor, James Spencer & Sons Construction Co., employed an unusual variation.

The road for about 600 ft. passed over a mucky soil thickly timbered. The muck was 3 to 5 ft. deep, underlaid with wet sand and covered with a mat of roots, vines and grass 3″ to 16″ deep; while stumps of 4″ to 40″ diameter, left in clearing the right of way, average 70 to each 100 ft.

First five rows of holes, spaced 5 ft. apart, longitudinal of the road, were punched from 30″ to 35″ deep, 18″ apart, and shot with 50% 1¼″ x 8″ Hercules dynamite, producing a trench about 30 ft. wide and 4½ ft. deep. When the entire length had been so opened up, fill material from near one end was delivered by two 7-yd. continental scraper wagons drawn by caterpillar diesel tractors and pushed into the trench by a bulldozer, until the material banked up in front of the bulldozer about 6 ft. high. As this bank was pushed ahead into the trench, it displaced muck which had been left in the trench by the shooting. The second morning this muck had so stiffened that the bulldozer could not move the bank, and four 50% cartridges were charged in each one of a row of holes along the toe of the bank, spaced 14″ centers and 40″ deep. When these had been fired, the bulldozer could proceed easily as before. The same toe shooting was repeated at 190 ft. and 300 ft. from the beginning.



Upper diagram shows layout for trench blasting. Lower one, method of placing fill and shooting toe

As the fill progressed, the muck built up to such an extent that it was spilling back onto the fill, and some of the muck was working its way under the fill material. To remedy this condition, relief ditches were shot. Three such shots were fired with 18-in. hole spacing and three cartridges to a hole. A fourth relief ditch was shot with the same hole spacing, but loaded with four cartridges to a hole. The total length of relief ditch in the four shots was 150 ft. The ditches were effective in providing a way of escape for the semi-liquid muck which was banked up in the main trench ahead of the advancing fill.

Grading and Draining a County Road

By HARALD J. HAYNES
County Surveyor, Turner County, Parker, So. Dakota

Our most interesting job this year was the grading of six miles of what we call the Davis-Centerville Road, beginning at U. S. No. 18, about one-half mile east of the Town of Davis, and extending south across very level land, broken only by the Vermillion river and by a county drainage ditch.

The job was done with the following equipment: one "60" Caterpillar tractor; one "RD8" Caterpillar tractor; one 42″ Caterpillar elevating grader with power takeoff; one hand-operated Adams 12′ blade with attachments of our own fabrication for cutting back slopes and finishing shoulder slopes; one Continental wagon scraper—7 yd.; and one Adams rotary fresno—2 yd.

W.P.A. labor was utilized in clearing and grubbing trees, stumps and rocks; taking down and resetting existing fence lines, and hand-finishing the grade and back slopes.

The bulk of the dirt was placed by straight side casting, using a long stacker, pulling the elevator with the RD8, except when this was being used with the wagon scraper for hauling dirt to balance the few places that a balance was necessary; or hauling dirt, which, because it was from a borrow pit, was not accessible for side casting with the elevator.

The interesting feature of this job was the drainage question. The land on both sides of the north 1½ miles was very nearly level, and yet was required to take the water from quite an area (including overflow water from the Vermillion at flood) so that the matter of ditch profiles became of a greater importance than the center line grade profile. Also a county ditch, which parallels the west side of the road along the south mile of these 1½ miles, presented a problem. Either the road had to be moved east to provide a wider ditch of the same depth as the original ditch, or the ditch had to be moved further west, or the original ditch had to be duplicated and a spillway or bridge placed in the road at a distance of some 2,000 feet north of the bridge over the Vermillion.

After considering the cost and the practicability of the various means available, we finally solved the problem by acquiring more than the normal one-half rod of extra right of way, that was acquired along the rest of the project, thus making it possible to keep the grade on the section line, make our ditch wider, and build up our grade, which previously had been susceptible to washouts due to spring floods, through the long gradual draw north of the river, with the result that we have a ditch which will carry more than twice its original capacity and is ample for the slow-moving but turbulent flood waters; and we have a road surface grade that is sufficiently high to resist the effects of the flood waters.

The Editor's Page

The Proof of the Pudding

We recently found, in a collection of papers prepared for sanitary engineers, one whose title indicated that it was devoted to "operating features" of a given type of treatment plant. Thinking that it would give us most welcome information concerning either how to operate such a plant or the results obtained by the actual operation of one, we began reading it with high hopes, to be quickly disappointed. We found one short paragraph on the "how" and another short one on the results; the rest was historical and descriptive of standard construction details.

Much of the credit for real progress in sewage treatment must be given, not to engineers, but the manufacturers of equipment and materials used therefor, who have conducted more or less exhaustive experiments and investigations on the actual results in practice of the use of their products; and most of the remaining credit is due to the few fortunate engineers who have secured funds from large municipalities or states for constructing and operating experimental plants. Designing engineers too seldom have opportunity of learning how their designs operate, in practice, in sufficient detail to permit them to improve and perfect them. A few recently have embodied, in their contracts for designing and constructing plants, a provision that the plant shall be operated under their supervision during its first year. This is excellent for the city, which thus gets its plant "broken in" and started off in the contemplated manner; for the operator, who learns how to run the plant as he probably could in no other way; for the designing engineer, who learns, as he could not otherwise, how the plant really works and what features could be improved upon and how; and for all future clients of the engineer, who will undoubtedly benefit in their plants by the knowledge he has thus been able to acquire.

It will, we believe, be a great day for sanitary engineering when all State health boards require this practice in every case.

Articles for the Average Engineer

In sending us an article which appears elsewhere in this issue, Ben C. Dale, county engineer of Richardson County, Nebraska, says: "Most articles appearing in construction magazines are over the heads of the ordinary lay engineers. That is, they describe unusual constructions and problems that are encountered on large and expensive projects, which are of particular interest only to men engaged in a similar construction. Not many engineers will ever need types of construction and equipment such as are used on the Boulder dam or the Golden Gate bridge. True, they are interesting reading and make wonderful pictures, but that won't help the average engineer very much. Likewise, some men seem to have abundance of money to purchase all kinds of equipment for every need, but the real engineer is the man who has to operate on a very much curtailed budget and use a lot of ingenuity to make ends meet and use available equipment."

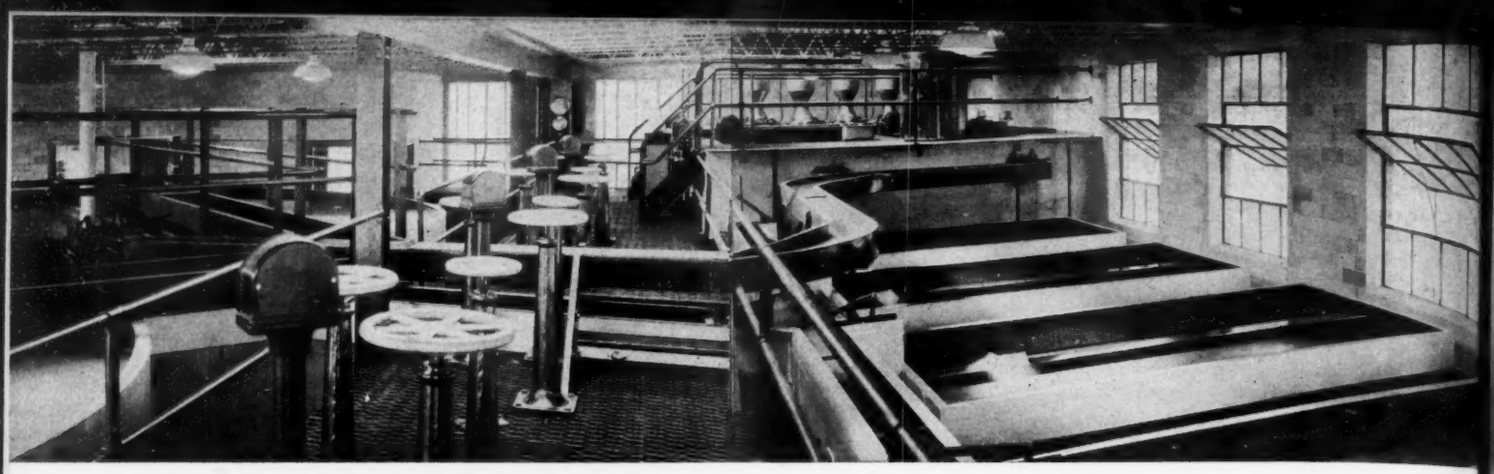
Mr. Dale's ideas are precisely our own, and are followed in selecting articles for PUBLIC WORKS. It would be easy to fill the magazine with spectacular articles describing works that appeal to the popular imagination —the Sunday papers have discovered that, and most of the engineering magazines yield to the temptation. We endeavor to edit this one for the benefit of the average engineer—the "forgotten man" in the field, and furnish material that will help him rather than merely interest him. We are always glad to receive suggestions that will aid us in doing this.

Imitation Engineering

The easiest way to "design" an engineering project is to copy one that has already been designed to meet approximately similar conditions. But that is not real engineering. Engineers now have almost infinite numbers of materials and construction methods at their disposal, and know much more about the underlying principles involved than did their predecessors whose designs they may be copying. Real engineering involves a consideration of all the conditions to be met and all the means available for meeting them, and adopting those of the latter that best solve the problems presented by the former.

Illustrations are offered by several recent constructions. Most sewage treatment tanks have been built of concrete wholly or partly underground; but in a Florida plant recently built, all the tanks are of steel and above ground, apparently for excellent reasons. (Such construction, however, might be wholly inadvisable under other conditions, as in a northern climate.) A water tower or reservoir was desired in a cold climate, at an elevation higher than the bottom of a cliff but lower than its top; an elevated tank would give the desired elevation but be almost sure to give freezing troubles; the solution adopted was a large chamber blasted out inside the cliff itself. Dams were formerly built of either earth or masonry, but in some locations sufficient earth is not available and, owing to the remoteness, labor and cement are impossibly expensive, and the rock-fill dam was born. Later, to make this water-tight, a rustless-steel facing welded into a single enormous sheet was devised, with crimped joints to allow for temperature changes.

Standards have their uses—many kinds are invaluable, especially those dealing with basic materials. But a man who, in "designing" a project, copies some previous plans (his own or some one else's), considering only size and other outstanding characteristics of the project in making any modifications, and uses sets of standard specifications in connection therewith, is too mentally lazy to deserve the title of engineer—an intelligent foreman could do that much. Possibly a new problem *is* best met by the same means as a previous one; but before believing this I should consider every alternative that my ingenuity could evolve, and wonder why I had not advanced in knowledge and skill meantime.



Left—Top of clarifying tank. Right foreground—Aerator pans above filters. Right rear—Mixing tanks and chemical feeders. Winding across the center, the trough carrying dosed sewage to tanks. Center, from front to rear, the operating gallery.

A Year's Operating Costs and Results of the St. Charles Sewage Treatment Plant

THE sewage treatment plant of St. Charles, Illinois, using what is known as the Putnam process, was put into operation on September 23rd, 1936, and the data for the first year's operation are now available. These data cover the twelve months from October 1, 1936, to September 30, 1937, inclusive, and have been compiled from the daily reports kept at the plant.

The plant was described in PUBLIC WORKS for January, 1937. It provides for complete treatment of the sewage of a city of 7,400 population, including the distillation of the sludge into materials which are not only innocuous but have a commercial value. The figures show a reduction of 5-day B.O.D. from 220 p.p.m. to 10 p.p.m., and of suspended solids from 245 p.p.m. to 7 p.p.m. The flow averaged 754,519 gallons a day, or about 100 gallons per capita.

The total operating cost, including that of sludge destruction and heating the building, was $16.26 per million gallons. The construction cost of the plant was $76,000. (As the entire plant is enclosed in one building 78 by 66 feet, the amount of land required is remarkably small.) If we add 10 per cent for interest and depreciation on this cost, we have a total cost of $49 per million gallons. This is comparable to that of an activated sludge plant provided with sludge dewatering and incinerating equipment; with the advantage over such a plant that the entire process is housed in one small building of attractive architecture, which, since there is no offence to either sight or smell, can be placed wherever it is most convenient.

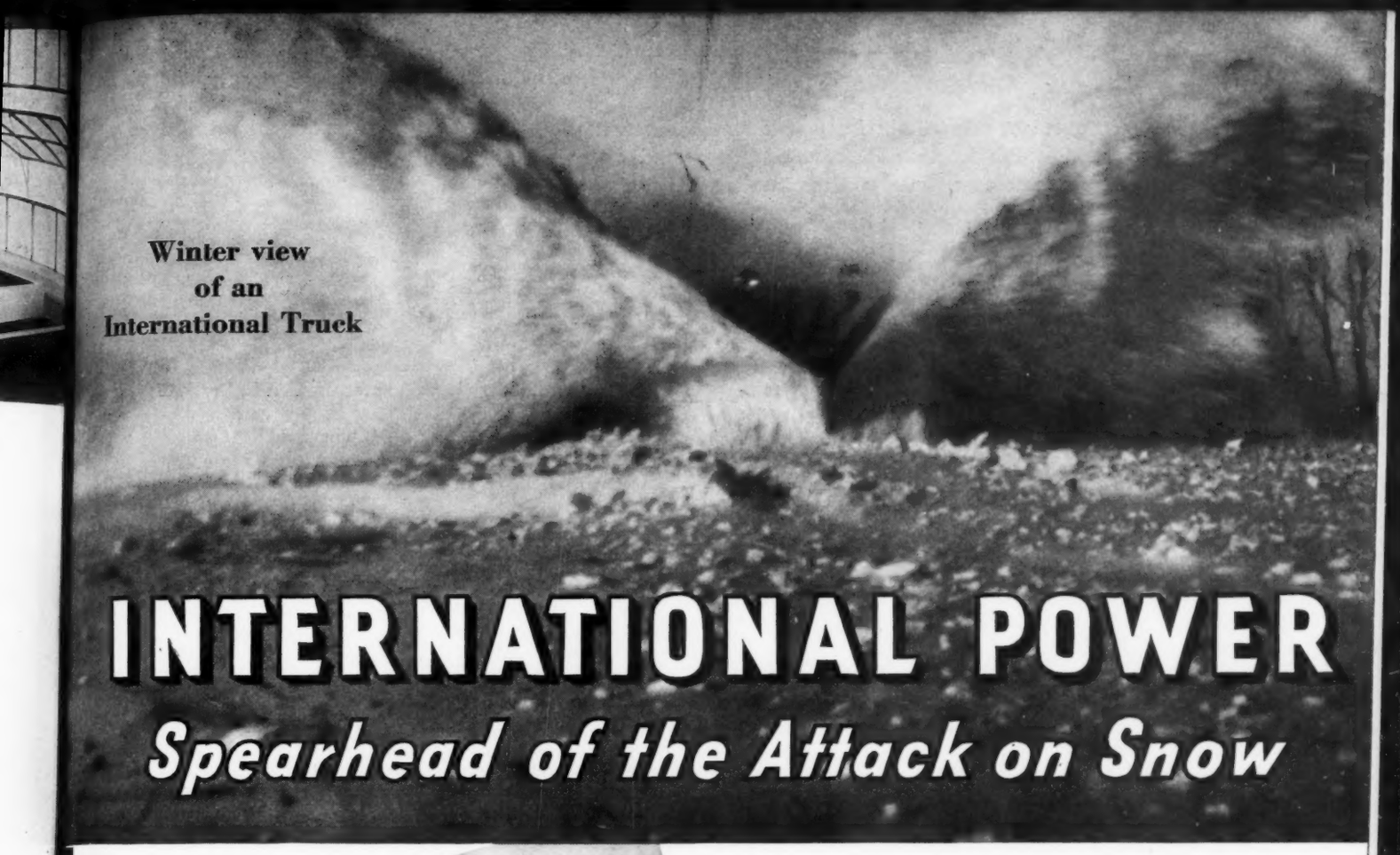
Stated concisely, the process is as follows: The solids are comminuted; lime, carbon and ferric chloride are added, and the solids settled out; the effluent is filtered through rapid sand filters and chlorinated. (Chemicals used per million gallons—lime, 250 lbs.; ferric chloride, 170 lbs.; chlorine, 5 lbs.) The sludge is settled, dewatered on a vacuum filter and distilled to carbon, distillate and gas. Part of the carbon is applied to the crude sewage, and the gas is used to fire the retort. Power is used for operating paddles in the mixing tanks, pumping wash water (final effluent) for the filters and sludge to the vacuum filter; also operating chemical feeders and other minor operations.

Results of Treatment

Total gallons treated	275.4 Million.
Average 5-day B.O.D. raw sewage	220 p.p.m.
Average 5-day B.O.D. effluent	10 p.p.m.
Percent reduction	95.4
Average suspended solids, raw sewage	245 p.p.m.
Average suspended solids, effluent	7 p.p.m.
Percent reduction	97.1

Cost of Treatment

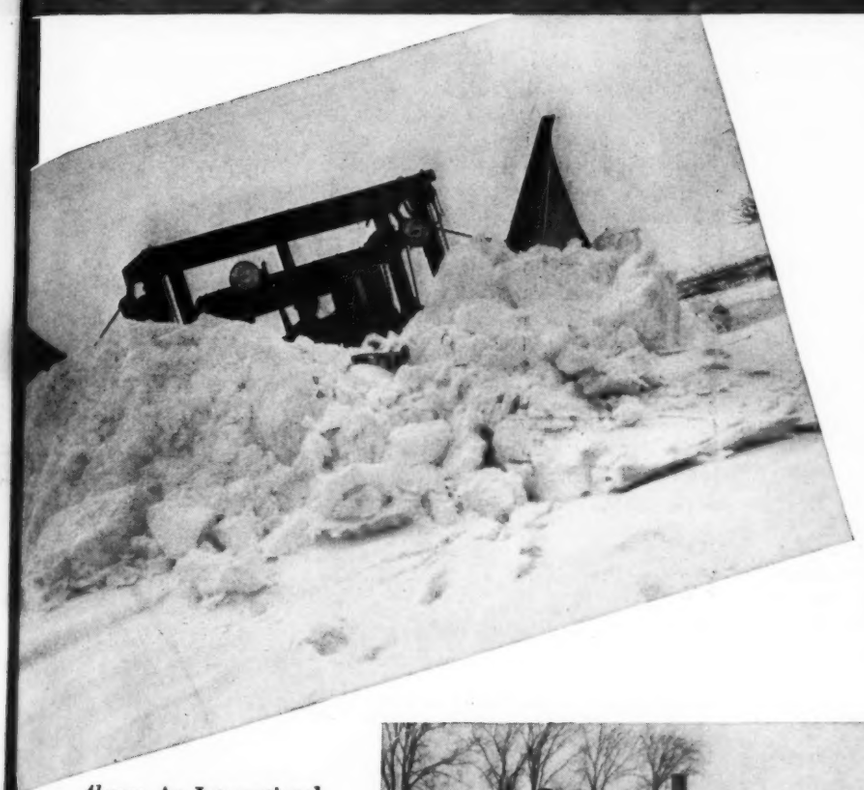
Chemicals	*Cost P.M.G.*	*Cost*
Lime—68,850 lbs.		$ 344.25
Average P.M.G. 250 lbs.	$ 1.25	
Ferric Chloride—46,818 lbs.		852.09
Average P.M.G. 170 lbs.	3.09	
Chlorine—1,377 lbs.		96.39
Average P.M.G. 5 lbs	.35	
Total cost P.M.G.	$ 4.69	
Total chemical cost—275.4 M.G.		$1,292.73
Electric Current		
Power—42,687 KWH		533.59
Average—155 KWH P.M.G.	1.93	
Lighting—16,500 KWH		206.25
Average—60 KWH P.M.G.	0.75	
Total P.M.G.	2.68	
Total current treating 275.4 M.G.		739.84
Labor		
Labor		2,400.00
P.M.G.	8.72	
Maintenance		
Maintenance		225.50
P.M.G.	0.82	
Supplies		
Supplies		121.60
P.M.G.	0.45	
Fuel		
Destructive Distillation of Sludge and Heating Building.		
Oil Used—19,250 Gallons		1,155.00
P.M.G.	4.20	
Total Cost		
Total cost of plant operation, 12 months		$5,934.67
Total cost of plant operation P.M.G.		21.56
Average flow—754,519 gallons per day.		
Total daily cost of complete operation, including sludge destruction		16.26



Winter view of an International Truck

INTERNATIONAL POWER

Spearhead of the Attack on Snow



● When blizzards block the highways it's mighty satisfying to have International Trucks and Tractors battling the drifts. Here is POWER for any emergency . . . ready to go into action at the first sign of a storm . . . able to stay on the job without any let-up until the roads and streets are wide open to traffic. Map your snow-removal campaign around International Power. Bank on these 4- and 6-wheel trucks, crawler tractors (gasoline and Diesel), and wheel tractors (gasoline and Diesel) to break the grip of winter. See the nearby International dealer or Company-owned branch now and be all set for winter. And remember this: the investment you make in International Trucks and Tractors is a year-round one . . . *they will power your other road equipment just as efficiently.*

INTERNATIONAL HARVESTER COMPANY
(INCORPORATED)
Harvester Building — Chicago, Illinois

Above: An International TD-40 Diesel TracTracTor driving a V-type plow through a drift with the greatest of ease.

Right: Bulldozing the snow clear off the road with an International TD-40 Diesel TracTracTor.

Below: 600 International Tractors are owned by the City of New York.

These are a few of the 315 Model I-30 Tractors, with cross-walk plows and cabs, bought last winter. (Photo by New York Sun.)

Following is a digest of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form.

The Water Wheel

An above-ground softening plant for St. Petersburg, Fla., desirable because of hydraulic grade conditions, has been constructed in eight welded steel tanks, which house the aeration, softening, coagulation and filtration units and the chemical storage and feeding equipment. Four tanks are 50 ft. diameter, one 60 ft., one 15 ft. and two 10 ft. The plant contains a number of other unusual features of both construction and operation, including upward sedimentation, and reduces a bicarbonate hardness of 200 ppm to 100 ppm, using 646 lb. of lime and 99 lb. of ferric sulphate per million gallons.[E45]

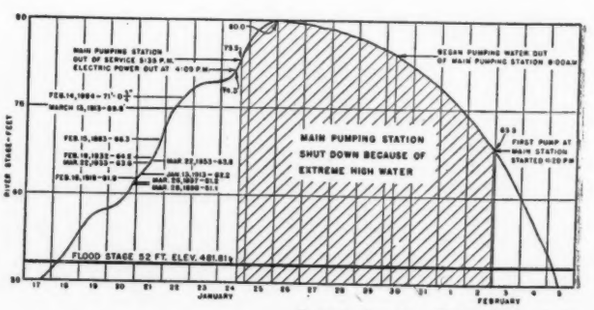
Adding taste to a water supply instead of removing it is to be practiced by Birmingham, Ala., in supplying water for industrial purposes only. It is proposed to super-chlorinate the water to give a taste to serve as a warning that it was not a potable supply, at the same time sterilizing it to protect any chance drinker against disease germs. Incidentally the chlorine probably will help to prevent the collection of slime in condenser tubes of power plants using the supply.[X1]

Typhoid rates for 1936, as reported in the Journal of the American Medical Ass'n., show a continuation of decline. Figures are reported from 93 cities; 18 had no typhoid deaths, 18 had rates of 2.0 per 100,000 and over. Combining the 78 cities for which figures are obtainable for 27 successive years, the rate has fallen from 20.54 in 1910 to 0.94 in 1936. Combined by geographic divisions, the rates for 1936 were: New England, 0.42; Middle Atlantic, 0.56; East North Central, 0.72; West North Central, 0.79; Mountain and Pacific, 0.80; South Atlantic, 1.55; East South Central, 3.35; West South Central, 3.99. Three cities had rates of 5.0 and over—Birmingham, 5.0; New Orleans, 6.5, and El Paso, 6.8; but the last two reported that one-third or more of the deaths were among nonresidents.[A139]

Gastro-enteritis was discussed at the June convention of the A. W. W. A. by eleven health engineers and specialists, and the discussion summed up by a committee of the society. These discussions "clearly indicated the absence of definite information on water-borne gastro-enteritis, the complexity of problems involved, and the need of correlated study by epidemiologists, pathologists, bacteriologists and sanitary engineers before definite conclusions may be drawn." It may not always be water-borne, but probably is in most cases. If water-borne, it may be due to (1) bacterial pollution indicated by present standards as to water quality or bacteria present for a short time during the onset of the epidemic which were not detected because samples were not collected at the critical time or place; (2) bacteria not disclosed by standard methods of examination of water; (3) lactose fermenting bacteria which have lost their fermentative ability, or which ferment slowly, or produce acid without gas formation; or (4) to toxic or irritating substances incidental to previous decomposition of organic matter or previous bacterial action and resistant to water purification processes. A. E. Berry said that one Ontario epidemic suggested fine quartz silt in the water as the cause. N. R. Ziegler suggested incubation of presumptive tests for at least 72 hours, preferably 96 hrs. (they may be only shocked, not killed, by chlorine treatment); he and L. W. Parr, direct inoculation in the field into plates as well as broths. Zeigler suggested higher chlorine doses, F. E. Hale opposed this; but frequent tests to insure some residual at all times is important.[A138]

Silica aids coagulation with alum — presumably a colloidal hydrous silicon dioxide possessing a strong negative charge—and adding more silica materially shortens the time required to coagulate with aluminum or ferrous sulphate and causes the production of larger and tougher flocs, permitting higher filtration rates. The amount of SiO_2 required to give nearly maximum aid to coagulation with alum is approximately 40% of the amount of alum used. In preparing a silica solution for this purpose, most of the alkali in a sodium silicate solution is neutralized with acid. Water containing considerable magnesium may be coagulated by use of lime and silica alone. Acid-treated sodium silicate aids coagulation with other aluminum salts, such as aluminum chloride and aluminum nitrate. Considerable aid is given by silica to coagulation of water with ferrous sulphate, but less to ferric salts. In discussion of the paper, it was said that the presence of silica, even as little as 5 ppm, in feedwater for high-pressure boilers is a most disturbing problem and the cause of costly maintenance and operation charges; also it causes deposits on steam turbine blading, and may have a destructive effect on steel ("caustic embrittlement").[A150]

Flood damages to waterworks plants and interference with water service was discussed in eight papers (78 pages), in the AWWA journal. Some of the suggestions for preparing for future floods were: Pumping plants, clear-water reservoirs, etc., should be located above the highest floods, or protected by levees placed as far as possible away to minimize flotation and pressure on walls. This is generally cheaper than supplying reservoirs to hold a reserve while plant is out of service. Steam equipment, particularly the reciprocating type,



Journal, American Water Works Ass'n.

Flood heights and pumping station operation at Cincinnati

Right up with ditcher was this 30" Dresser-coupled water line, as both neared their goal —Champion Paper & Fibre Company's new mill near Houston, Texas.

HERE, THERE, EVERYWHERE!

Dresser Couplings are "going places," geographically. For instance:

Buffalo, N.Y.
Kalamazoo, Mich.
Milwaukee, Wis.
Nederland, Colo.
Omaha, Neb.
Ottawa, Can.

This 30" well-water line, along the Houston ship channel, had to pass under numerous highways and railroads to reach a new paper plant*, 11 miles from Houston. Easily constructed with unskilled labor, the line gave a perfect performance on the first test. It is completely Dresser-coupled.

*Additional Dresser joints were used on the inside piping of above mill. A further order for more 30" couplings has since been received for extension work.

FIVE REASONS WHY MODERN WATER LINES ARE DRESSER-COUPLED:

1. **PERMANENT TIGHTNESS**—proved for 50 years, on 150,000 miles of pipe.
2. **FLEXIBILITY**—normal pipe movements—present in every line—are absorbed.
3. **SIMPLICITY**—joints are "factory-made"; ordinary labor can install.
4. **STRENGTH**—predetermined; joints safely withstand any specified pressure.
5. **TRUE ECONOMY**—a truly lower joint cost throughout the life of the line.

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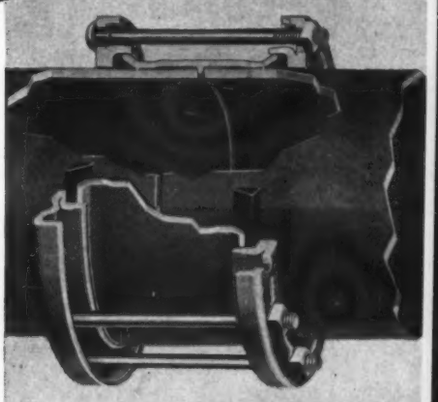

Cutaway view of Dresser Style 38 Coupling, showing working principle. Note that plain-end pipe is used. The resilient gaskets, flexing with the pipe, safely absorb pipe movements.

THE MODERN TREND IS TO DRESSER COUPLINGS

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is more reliable than electric—floods put many power plants out of service, and it takes much longer to get electric equipment into service after flooding. All electrical equipment in the station should be placed above high water, or cranes be supplied for hoisting them above high water on short notice. Steam turbines require time for cleaning before service can be renewed. Steam lines and electric cables should be placed above flood water level. All openings through foundation walls for pipes, etc., must be made watertight, sewers and drains be of iron and provided with valves. Sump pumps should be installed and kept in operating condition. Valves around the plant should be accurately located with reference to objects that will extend above flood water. Sufficient operating supplies and materials to last during a flood should always be on hand. When flood threatens, reservoirs and tanks should be filled and kept full.[A141-147]

Reservoir lining joints of Basin C of the Loudonville (Albany, N. Y.) reservoir were unusual in precautions against leakage. Slabs were generally 22.5 x 50 ft. Under each joint is a concrete sill 16″ wide by 6″ thick, smooth-troweled on top and covered with a layer of building paper. The slabs, generally 8″ thick, are left 2″ low for 28″ on each side of the joint and are ¾″ apart at the joint, this space being filled with 2″ depth of asphaltic mastic and the remaining 4″ calked with tarred rope oakum. A copper strip, crimped to an inverted U ¾″ high, is laid in a bed of asphaltic mastic with the crimp directly over the joint and bolted down to the concrete, and mastic applied to the top of the copper. Mesh reinforcement 24″ wide is fastened to each side of this strip and held by bolts, 1″ above the concrete. The 2″ depression in the slabs is then filled with gunite, a metal template held vertical on top of the crimp making an expansion joint, which is filled with expansion joint filler of low melting point. At joint intersections the copper strips are brazed together. Four weeks after the reservoir had been filled, the drop in the water surface had reached a minimum of 0.01 to 0.02 ft. per 24 hrs. at which it has remained.[F110]

Dam construction under conservative New England standards comprises earth embankments with concrete core walls set in base rock, a thick vertical section of impermeable material against water side of core wall, a bearing layer of homogeneous material on reverse side, banks of permeable material with comparatively flat slopes for weight and protection to the cutoff walls on both sides, and rip-rap on the water face. During the past 25 years slopes have been flattened, particularly on the water side, slope paving thickened where exposed to wave action, spillway capacity more generous, and exposed concrete surfaces eliminated. Cost of labor has increased and its efficiency decreased, but improvements in equipment and methods have offset this, so that unit costs have remained about the same in both earth and concrete work. Quantity production has increased fourfold and quality definitely improved.[F101]

Bibliography of Recent Waterworks Literature

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article

A *Journal, American Water Works Ass'n September*

140. Research on Grounding of Electric Current. Pp. 1223-1229.
141. The 1937 Flood at Huntington, W. Va. By J. C. Crenshaw. Pp. 1230-1236.
142. Cincinnati Water Works in the 1937 Flood. By A. S. Hibbs. Pp. 1237-1245.
143. The Louisville Water Company and the 1937 Flood. By L. S. Vance. Pp. 1246-1258.

BUILD A SWIMMING POOL *with* "GUNITE"!

A comparatively recent construction activity that we have pioneered is the building of "GUNITE" swimming pools for Country Clubs, resorts and private estates. Our photos illustrate the very satisfactory results obtained. Reading from left to right, are shown pools at Yountakah Country Club, Nutley, N. J., Lehigh Country Club, Allentown, Pa., and Hotel Bermudiana, Hamilton, Bermuda. Country Club memberships and revenues have increased and resort patronage has been augmented because of these facilities.

In the construction of this type of pool, which is copyrighted by the Cement Gun Co., the "GUNITE" is "shot" directly against earth excavation, over steel reinforcement, without the use of expansion joints.

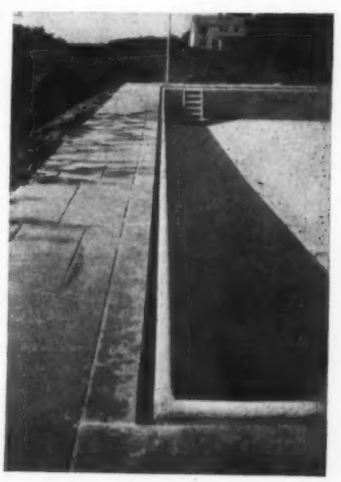
As a consequence, the cost of building a pool is reasonable and the operating expense is low. A "GUNITE" pool of good size can be built, complete with filter system and locker building, for around $15,000 to $20,000, and operated for about $275.00 per month.

We will be pleased to have our representative call and submit full details. Write us today!

REPAIR YOUR OLD POOL WITH "GUNITE"

This photo of a swimming pool on a private estate near Erie, Penna., shows how thoroughly and satisfactorily an old pool may be rehabilitated by the use of "GUNITE". The pool leaked due to badly disintegrated concrete. The inside was chipped and cleaned and "GUNITE" applied against new reinforcement, with the excellent results shown.

Investigation of this feature of "GUNITE" construction will be profitable to pool owners, public or private. Write us today!



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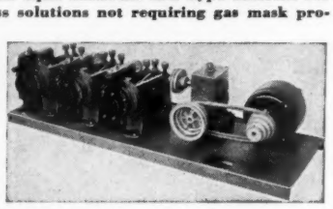

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Work of the Ohio Division of Sanitary Engineering

THE volume, importance and character of the work done by the Division of Sanitary Engineering of the Ohio Department of Health in 1936 and 1935 have been outstanding. The increase over previous years has resulted from the advantage taken of offers of federal aid, supplemented by the activity of the personnel of the Division in urging public bodies to take advantage of these opportunities for accomplishing much-needed sanitary improvements.

The federal aid sanitary projects undertaken during the past three years (it is difficult to separate them into individual years since many of them overlap) include 108 waterworks improvements under PWA and 368 under WPA, valued at a total of $19,812,719; 88 sewerage and sewage disposal improvements under PWA and 842 under WPA, valued at $46,907,235; and 22 swimming pool projects under WPA costing $677,000. These include 66 new water works systems, 39 new water treatment plants, 37 new sewerage systems and 45 new sewage treatment plants, in villages not previously supplied with such facilities.

An important point to note with many of these sanitary improvements is that they are to a great extent self-supporting. Most of the new water supply systems are being financed through mortgage revenue bonds; water and sewer systems may be declared utilities and service charges used to amortize revenue bonds for the building of the works, as well as taking care of the operation of the utility. Previous to the advent of the federal aid program of PWA and WPA, only two Ohio municipalities had ever availed themselves of the opportunity of financing water or sewerage improvements by means of mortgage revenue bonds although provision for such financing has been specifically in the State Constitution since 1912. Ohio has been the pioneer in this field of financing, and as a result of the general acceptance of this method by the federal PWA other states have adopted simililar statutory enabling acts so that water and sewerage improvements might be instates have adopted similar statutory enabling acts so

Work done by the Division on industrial waste treatment last year included one plant for treating acid iron, one for beet sugar, one for brewery wastes, 3 for canning wastes, 4 for milk wastes and 2 for oil.

One of the major activities has been the sealing of abandoned coal mines. During 1936 there were 9066 closures costing $397,038 and employing about 700 men regularly; labor receiving 88.6% of the total expenditures, materials 2%, and superintendence 9.4%. WPA furnishes county supervisors, foremen, labor and part of the material. The sponsor furnishes technical supervision, laboratory service and the remainder of the materials. An assistant engineer from the State Department of Health has been designated as acting director of the project. Up to the first of this year about 64% of the closures needed had been effected.

Another major work performed in Ohio under the auspices of the U. S. Public Health Service and the WPA is the construction of sanitary privies upon rural properties, 33,377 units having been constructed in 1936 at a cost of $1,973,965, of which WPA furnished $1,229,041 for labor and the sponsors $744,924 for material. It is estimated that this program is about half completed.

This work, together with many other duties of the Department, has been carried on by ten engineers, of whom F. H. Waring is chief engineer.

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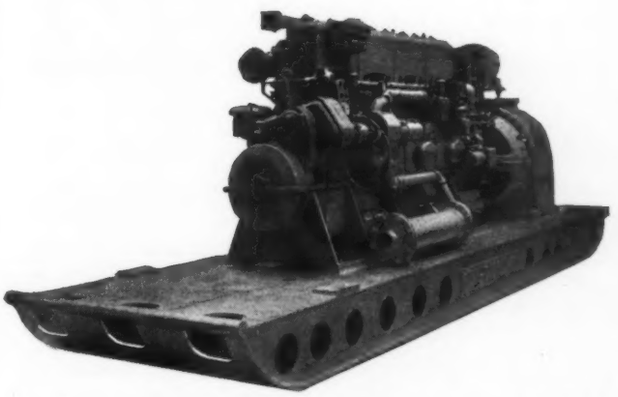

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Building Porous Concrete Wells

By J. A. RAFFIELD

City Manager of Sumter, S. C.

J. A. Raffield

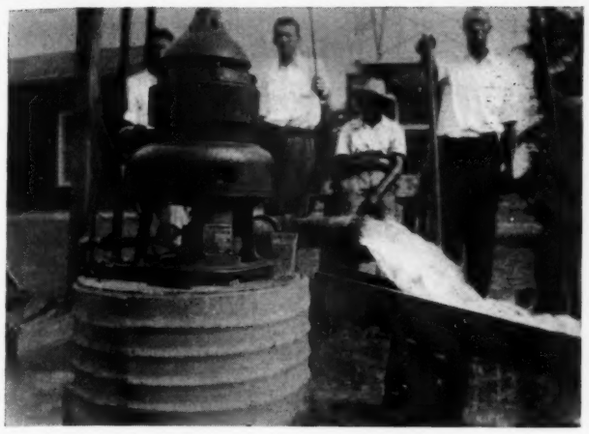
THE water supply system of Sumter was installed in 1892 and operated by the Sumter Water Company until 1905, when it was purchased by the city and since then has been operated by it. The plant consisted of a pumping station and 6-inch driven wells with bronze strainers connected to a common suction line. Wells driven to depth of approximately 50 feet furnished a supply of good water. Others driven to a greater depth contained some iron.

In 1929, additional water from the upper stratum being needed, F. K. Ellis (then and still the waterworks superintendent), the city manager and city council, studied the possibilities and decided to try a well using porous concrete pipe at the bottom and impervious concrete for the remainder of the well, 24-inch pipe being used to obtain a greater area of strainer surface and so give more yield than the 6-inch wells. This type has proved so successful that we are now completing our twelfth well. These wells are constructed as follows:

A pit is dug by hand to a depth of seventeen or eighteen feet which goes through the top sand and some seven or eight feet of clay to a bed of sand clay. Upon reaching this sand clay, the 24-inch porous concrete pipe is placed in the pit and an ejector or jet fed by water from the pumping station is used to sink the pipe. The first section of pipe is protected at the bottom by a cutting band of metal which accelerates the work and protects the pipe. Additional pipe (which is in 3-foot sections) is added as needed, the joints between pipe being well cemented and firmly held together by four tie rods, which keep the pipe straight.

Top of a completed well

After going through this sand clay seven or eight feet,



Sinking a 24-inch concrete pipe for a well

water bearing sand is entered and continues between twenty and twenty five feet. There is, at a total depth of about 52 feet, a ledge of impervious material on which the pipe is allowed to rest. A concrete plug is then poured in the bottom of the well, thus further strengthening the installation and preventing sand from entering.

Approximately 21 feet of porous pipe is used in each well. By using a jet in sinking this pipe, the well is developed and also a well-developed basin adjacent to it, thus allowing a maximum supply of water to filter into the pipe. A pump, turbine or deep-well centrifugal type, is placed in the well, using in most cases a 5 HP motor.

We have six of these wells so equipped which furnish more than one thousand gallons per minute of pure wholesome water. Three of the wells are connected to a suction line operated by a 250-gallon triplex pump. The remaining three wells are kept in reserve.

The water is pumped to a small reservoir or catch basin and is aerated as it enters this reservoir for the removal of CO^2 gas, thereby bringing the PH to neutral. From this small reservoir it is pumped into our distribution system.

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Committee on Sewage Treatment Costs

A committee to study sewage treatment costs is in the progress of organization by the Sanitary Engineering Division, American Society Civil Engineers. The general purpose of this committee is to consider the various factors which affect the construction and operating costs of sewage treatment, and the comparative economies of various types of sewage treatment processes with a view of outlining orderly procedures for recording and relating the various cost factors. The presently appointed committee members include Paul Hansen of Chicago; George H. Schroepfer of Minneapolis; A. H. Wieters of Des Moines, Iowa, and Wm. E. Stanley, Chairman, Ithaca, New York.

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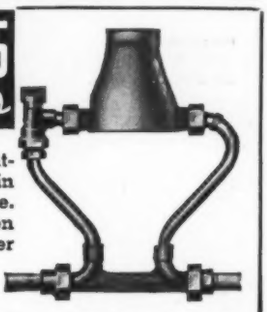

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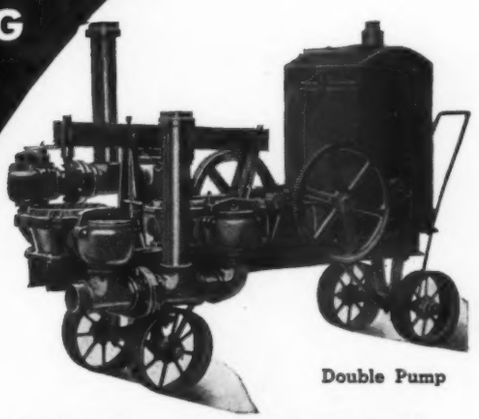

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View through completed culvert showing drop inlet beyond. 20-foot fill to be placed over arch

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Highway Culverts Aid Soil Conservation

How a Nebraska County, with PWA Aid, Combines Soil Conservation with Improved Highway Culvert Construction

By BEN C. DALE

County Engineer of Richardson County, Nebraska

DURING the past four or five years, nearly all county governments have been faced with the problem of working a large number of men on relief programs. At first almost any type of work would do, such as leaf raking and moving dirt long distances with shovels or wheelbarrows. Now under W.P.A. rules a more efficient type of work is required and likewise the man-year cost has been reduced to about $600. Since ordinary construction costs run about $1,500 to $2,000 per year, it is evident that the present W.P.A. projects require considerable figuring to find suitable work and still hold down the sponsor's costs for material and equipment. Likewise the heaviest load of men comes in the winter time when most road projects can not be operated because of frost and weather. In counties gifted with bank gravel pits and rock quarries, this type of work is very adaptable to adverse weather. I often wonder what kind of projects are operated where these materials are not available and where the winters are very severe.

Box culvert, with drop inlet in foreground

Richardson County, Nebraska, has a very large number of bridges and culverts and, due to the nature of the soil and the swift runoff, often exceeding the coefficient of one in Talbot's Formula, is confronted with a very serious problem, of both culvert construction and soil erosion. The people in general are not interested in the drainage structures but more so in the surfacing of the roads so that they can travel in bad weather. This makes the task all the harder for the engineer, but we believe that he should contribute his share to the great erosion problem and calamity of the entire nation.

The photographs accompanying this article illustrate some of the W.P.A. work undertaken by Richardson County in the first year of W.P.A. program. We in this county take considerable pride in the fact that all culverts are constructed with a type of drop inlet which fills up the ditches, stops erosion, and in many cases is of enormous benefit to the land above the culvert. In the past fifteen years we have constructed about 300 of these culverts and the results are many times surprising. Please note that no attempt is made to place the inlet too high at first, but that provision is made for raising the drop inlet from time to time as the upper ditch silts full; and it is surprising how soon it will do this. If the inlet is constructed very high above the stream bed, I would recommend that the fill over the culvert be rolled or tamped. After trying various types of inlets we are of the opinion that the type shown works the best. It has been our custom to provide an inlet twice as large as the culvert in area and also to construct a headwall which prevents a whirlpool and washouts along the box.

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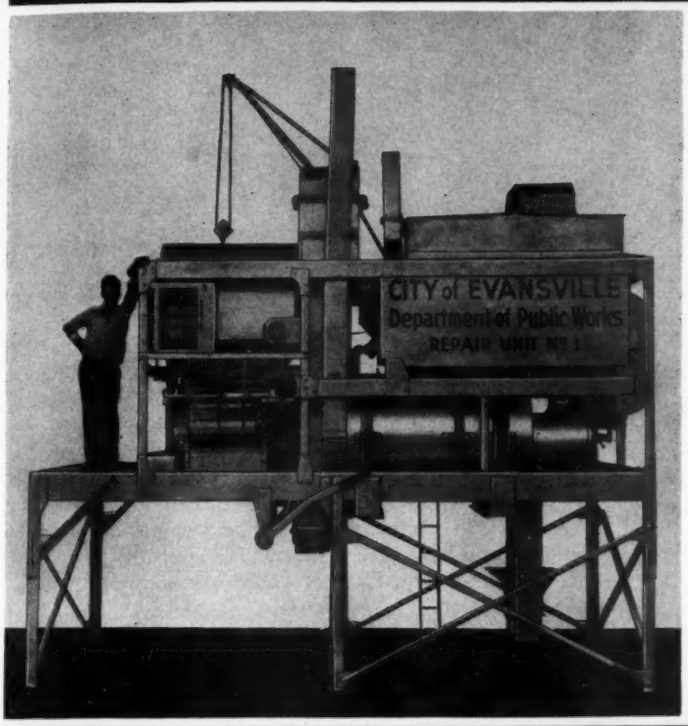

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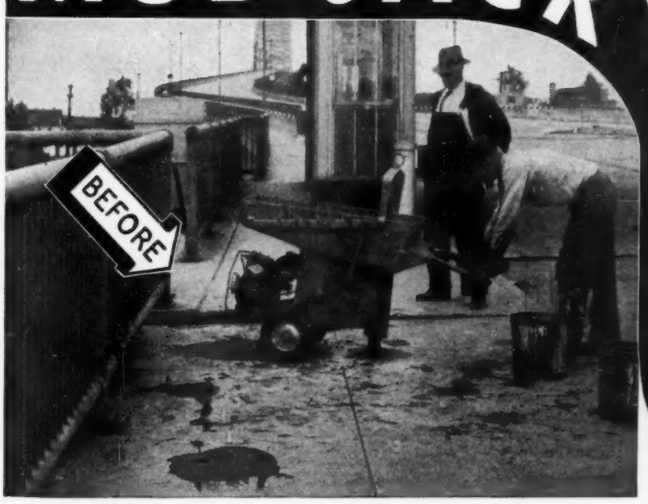

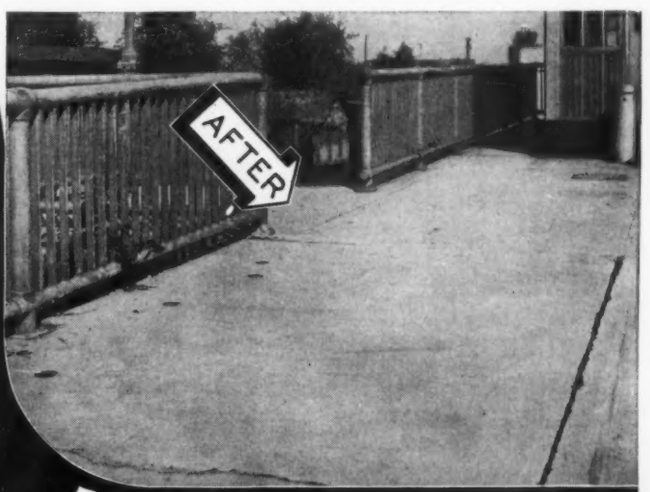

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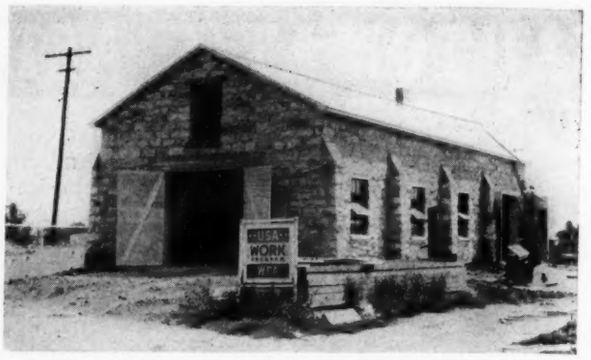

Native rock garage at Humboldt, Neb., with small shop in rear and storage room above

for materials has been reduced more than 50% and consequently we have gone into the construction of native rock masonry arch culverts. Where stream beds are solid and stable, this type of work gives excellent results and we have found that it does not require much skill to lay the rock. We use a circular wooden arch to form the top, which is boarded tight and stones are laid in motar on the arch. The straight side walls of the culvert are varied to suit the size of waterway required.

Liability for Negligence of Driver of Rented Truck

In an action against a highway contractor for death in an automobile accident, based on the negligence of the driver of a truck rented by its owner to the contractor along with the service of the driver to haul gravel, the Arizona Supreme Court held, Lee Moor Contracting Co. v. Blanton, 65 Pac. (2.) 35, that the owner of the truck would be liable, to the exclusion of liability of the highway contractor, if the former had control or the right of control of the conduct and acts of the driver in hauling the gravel, since the driver would be his servant and not that of the contractor. The question as to whose servant the driver was was held for the jury. The court applied the rule that as long as the employee is furthering the business of his general employer by service rendered to another he is the servant of the former. But under the evidence, although it does not conflict, there may be reasonable doubt as to who had the control or right of control at the time. Judgment for plaintiff was therefore reversed for a new trial.

Award for Extra Work

The Pennsylvania Supreme Court, in Canuso v. City of Philadelphia, 192 Att. 133, held that the award of a city director of public works that the city, by its engineers, and not the contractors, was responsible for the collapse of the false work on a bridge constructed by the contractors, was final, on the principle that a contractor who builds according to the owner's plans is not responsible for the sufficiency of the work, even though he is a specialist. But since the arbitration clause of the contract, on which the award was based, must be read along with another clause in the contract fixing the city's maximum liability, it was also held that the award did not warrant recovery by the contractors for the cost of repairs necessary to the false work prior to further construction of the permanent structure, to a greater amount than the city's maximum liability on the contract. The contractors were held entitled to interest from the date when the value of the work was finally determined.

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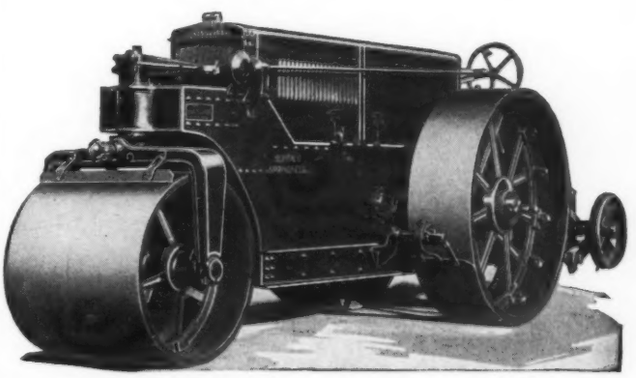

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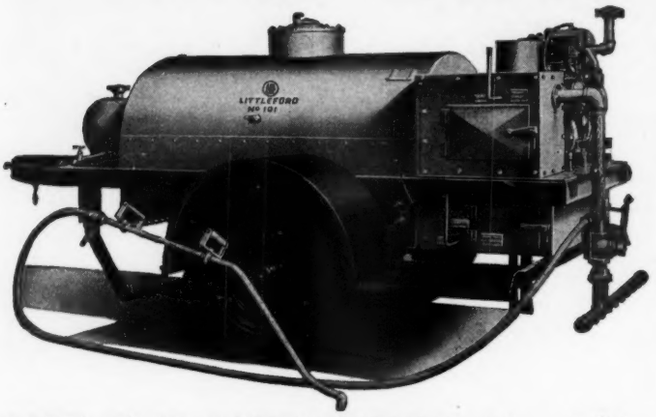

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Selecting Street Name Signs

An investigation of the various materials available for street signs has been conducted recently by the city purchasing office in Saginaw, Mich. Numerous manufacturers submitted eleven sample signs, each of which was subjected to gruelling tests.

Two of these signs were of metal alloy, three were of aluminum plate, four were of steel, galvanealed or rust-resisting; one was of cast aluminum alloy and one was of gum wood. Curiously, the gum wood sign was "tops" in the final rating.

The winning sign carried black on white letters 3⅞ inches in height, and formed by a "stroke" ¾ of an inch wide. Twelve letters of these dimensions need a sign about 40 inches long, but tests showed such signs were visible from a distance of 259 feet.

The cast aluminum sign scored second highest as regards visibility, its black and silver letters nearly three inches high but formed by a stroke of only ¼ inch, being visible from a distance of 165 feet. All the metal signs carried "thinstroke" letters, in varying color combinations.

Durability of the signs was tested by throwing half-bricks at all the samples from a distance of 10 feet. The cast aluminum sign proved most durable, the gum wood rated second. Least durable of all were the aluminum plate signs.

Officials who conducted the tests placed great importance upon the ability of the signs to withstand stones, baseball bats and such missiles as are hurled from juvenile slingshots. Several cities having cast iron signs have noted especially heavy casualties in the vicinity of schools.

The tests showed that most metal signs have a tendency to chip easily, thus opening the way for rust, and also to bend and crack. The gum wood sign was not vulnerable in any of these ways.

The final controlling factor, however, in the selection of gum wood over cast aluminum was the item of cost, plus visibility. The cast aluminum sign, admittedly most durable, was the most costly of all samples. Even with small letters, the sign would cost from $9 to $11 per street intersection—a virtually prohibitive installation charge.

In commenting on the selection, Byron J. Rockwood, acting purchasing officer of Saginaw, says: "Metal signs may be attractive in appearance, but they are inferior in durability to properly painted wood, and the glare on the metal surface greatly reduces its visibility under comparable conditions of light. Wooden signs are more easily serviced than metal ones and signs made of one piece of durable wood last longer than the metal type. The conclusions are supported not only by the tests made in Saginaw, and in the PAS report referred to above, but also by an independent survey made a few years ago by the Michigan Municipal League in co-operation with the board of public works in Ann Arbor, Michigan. As the result of tests that were made at that time, the city of Ann Arbor adopted a gumwood sign with four-inch raised letters, carved in the wood and painted white with the rest of the board painted black. The raised letters make the sign visible from several angles and make it possible to repaint them quickly by using a roller. The use of wood permits the use of a larger letter than is possible with metal, considering the cost of the material."

St. Charles, Ill.
Above, Front of building which contains treatment plant.
Right, Reception Office and Laboratory.

Complete Sewage Treatment in One Building a Proven Success

PUTNAM PROCESS

FOR THE TREATMENT OF SEWAGE

THE Putnam plant in St. Charles, Ill., a city of 7,400 population, has now been in operation for a full year. It is housed completely in one building 78 x 66′, built with ornamental brick at a total cost of about $76,000, including all equipment.

This plant treated on an average 754,519 gallons of sewage a day having a B.O.D. of 220 ppm and suspended solids of 240 ppm and gave a reduction of B.O.D. of 95.4% and a reduction of suspended solids of 97.1%.

The plant gives no offense either to sight or smell.

Three Putnam plants are now in operation. They can be made architecturally pleasing and located anywhere most convenient without injury to adjacent property.

Salient Features

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❸ It is elastic as to varying temperatures, volumes and contents, including any industrial waste.

❹ Enclosed in one building. . . . Not subject to weather conditions. . . . No sludge beds or digesters. . . . Is adaptable to Cities, Villages, Institutions and Industries. . . . Does not require the services of an expert.

Visit One of Our Plants

Mayors, city managers, sanitary engineers, city engineers, aldermen and others interested in the sanitary, efficient disposal of sewage, are invited to inspect our St. Charles, Ill., plant at their convenience, or submit sanitation problems.

We serve as engineers or consultants. Correspondence invited. Write to

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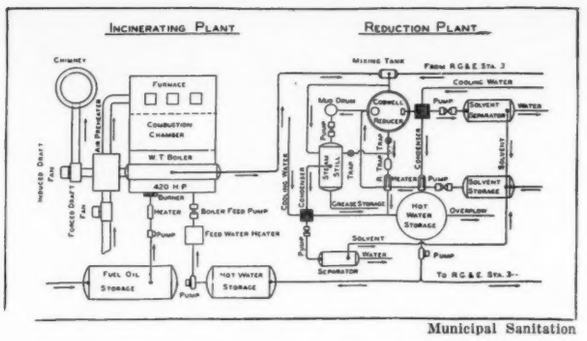
Turn to pages 63-65 for descriptions of helpful booklets and catalogs.

A Digest of Current Sewage Literature of the Month

The Digestion Tank



Municipal Sanitation

Flow diagram of refuse disposal plants at Rochester, N. Y.

Refuse incinerators at Rochester, N. Y., costing $400,000, now under construction, will replace old rubbish sorters and incinerators. Sorting cost 3 or 4 times the revenue produced. The new incinerators are expected to furnish twice as much steam as the old ones. The adjacent reduction plant uses all steam now produced and additional purchased steam costing $50,000 a year (but 2,000,000 lb. of recovered grease a year and $5,000 from the sale of hot, soft waste heating water almost meets all operating costs). The plant will contain an 18,000 cu. yd. dumping pit, 2 furnaces and 2 boilers, and a 250 ft. chimney. Steam will be used by reduction plant at 150 lb., but plant is built for a working pressure of 250 lb. The furnaces are of the refractory type, each with 135 sq. ft. of grate surface; arches are of the suspended type and side walls sectionally supported; 3 charging hoppers per furnace. Boilers are Keeler two-drum water-tube type, each 420 h.p., fitted for either gases from furnace or oil fuel.[H42]

Refuse incinerators of New York City have a daily capacity of 7,000 tons and two additional ones of 600 tons each are under design. Since 1934 the Dept. of Sanitation engineers have designed the plants in all details and they have been built by contract. They produce steam by waste heat boilers and electricity by turbo-generators. One has a diesel for light operation when the plant is shut down, another (which supplies current for a 5-story municipal garage a block long) buys current for this purpose. Dumping floors are as wide as streets to prevent congestion. Every load is weighed on automatic scales. Fly ash is prevented from reaching the chimney. Thorough ventilation is provided. There is no salvaging—burning combustibles for steam is thought preferable. Electric collection trucks are being tried, being charged at one of the incineration plants.[H37]

Tallmans Island treatment plant, the third of 38 plants proposed for New York's sewage, is being rushed to completion to clarify the water front of the 1939 World's Fair. It provides for 40 mgd (ultimately 50 mgd), strictly domestic sewage. The site is 26 acres about 30 ft. above water level. Sewage from a small low area will be pumped to the plant. Hand-raked racks and mechanically cleaned bar screens (screenings to be ground and returned to sewage), and mechanically cleaned grit channels are followed by three primary sedimentation tanks with conveyor-type sludge collectors, two spiral-flow aeration tanks, and four final tanks, sludge from the last being returned to the aeration tanks. Primary tank sludge goes directly to digestion tanks. Excess activated sludge goes to sludge thickeners, and thence to digestion tanks. The 4 digestion tanks have floating covers; supernatant will be settled 6 hrs. and then go to plant influent. Digested sludge will be pumped to elevated storage tanks near a wharf, stored 5 or 6 days (and supernatant be decanted off) and discharged into sludge vessels for barging to sea. The plant effluent will be discharged in 21 ft. depth of water in front of the plant. Sludge gas will be used (augmented by purchased gas as necessary) for power, to operate pumps and blowers of 60,000 cfm. in capacity to provide air for aeration tanks and air lifts. A notable feature is provision in the aeration tanks to permit primary tank effluent to be admitted in varying amounts at three points in the tank, to provide distribution of loading.[E21]

Denver's new plant, 60 to 90 mgd. capacity, using chemical precipitation, mechanical filtration and sludge digestion, uses air for chemical mixing and grease separation, and paddle-type flocculators; Laughlin magnetite filters; sludge dried on the natural sandy soil with no underdrains, and removed on a belt conveyor; bulk chemicals handled pneumatically; ferrous chloride will be made and chlorinated. Grease and scum will be removed from tank by continuous flight conveyor, returning above the sewage, which pulls the material up an inclined trough. The flow of sewage throughout is controlled by push button control of electrically operated sluice gates. Sewage is carried to the plant across the river in a 78" elevated pipe made of copper-bearing steel, with stiffener rings, in two self-supporting 100 ft. spans. Buildings are of modernistic architecture—glass brick panels instead of window sash, dark green glazed tile up to the corbel and light gray glazed tile above this. Aluminum is used for the entire front entrance of the administration, entrances to connecting flumes, gauge housings, hand rails and wherever else practicable inside the buildings.[G25]

Sludge gas used for 14 months at Aurora, Ill., for operating gas engines contained from 0.113% to 0.008% hydrogen sulphide. No scrubbers were used, and after 9 months no evidence could be found of any deleterious effects on either engine interiors or exhaust heat exchanger. Once set in motion, the engines require almost no attendance from one week-end to the next.[G31]

Beet sugar wastes are of four main kinds, of which that known as "Steffen's waste" has a very putrid odor which sometimes it is impossible to remove with even 12.5 grains per gallon of activated carbon. Suggested methods are evaporation to dryness, direct application, or biological action and stabilization, or all combined. The first two are very expensive; the third is less so, its success depending upon the degree to which the stabilization proceeds.[G32]

Paint suitable for treatment plants differs for submerged and unsubmerged surfaces respectively. The former must chiefly resist oil and grease; the latter, gas. For submerged steel, rust-inhibitive pigments, with tung-oil synthetic resin varnish plus linseed oil as a vehicle; also hot bituminous coatings. Above the water line, most prefer a rust-inhibitive base coat and two coats of aluminum paint; no lead in primer; synthetic resin varnish as a vehicle for both primer and top coat, for it resists both acids and alkalies, and penetration of moisture and gases.[J22]

Bibliography of Recent Sewerage Literature

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

D *The Surveyor*
September 10

54. Purification of the Emscher River. By Max Pruss. Pp. 299-304.

September 24

55. Sewage Disposal at Burnley. Pp. 379-380.

E *Engineering News-Record*
September 30

21. New York Adds Another Sewage Plant. (Tallmans Island) Pp. 541-545.
22. Sewage Plant Power Generators Controlled Electrically. By A. C. King and F. N. Lockwood. Pp. 569-570.

Water Works and Sewerage
September

31. Gas Engine Performance at Aurora, Ill. By W. A. Sperry. Pp. 327-330.
32. Pollution of River by Beet Sugar Wastes. By W. D. Loreaux. Pp. 335-339.
33. The Sewage Treatment Works of Rayne, La. By J. H. O'Neill. Pp. 347-348.

H *Municipal Sanitation*
October

35. Sewage Disposal—Its Effect upon Public Health. By G. W. Cox and V. M. Ehlers. Pp. 498-501.
36. The Sanitary Engineer in Municipal Public Health Work. By C. G. Hyde. Pp. 503-505.
37. Waste Disposal Progress in Nation's Metropolis. By W. D. Binger. Pp. 506-508.
38. The Practical Value of Sewage Research. By W. Rudolfs. Pp. 509-511.
39. Progress in Sanitation Is Progress in Public Health. By T. Parran, G. M. Fair, C. A. Emerson, Jr., F. W. Herring and H. J. Darcy. Pp. 515-518.
40. Sewage Plant Operation: Operation of Activated Sludge Units. By W. H. Wisely. Pp. 526-529.
41. Expanding Scope of Engineering in State Health Departments. By C. A. Holmquist and A. F. Dappert. Pp. 530-531.
42. Rochester's New Era in Refuse Disposal. By J. V. Lewis. Pp. 512-514.

J *American City*
October

20. Refuse Collection and Disposal in Chicago. By J. J. Butler. Pp. 81-83.
21. New Primary Treatment Plant for the Sewage of New Haven. Pp. 88-89.
22. Maintenance Painting at Sewage Treatment Plants. P. 107.

K *Proceedings, American Soc. of Civil Engineers*
October

3. Aeration Tanks for Activated Sludge Plants. By S. W. Freese. Pp. 1535-1555.

L *Civil Engineering*
October

9. Tourist-Camp and Roadside Sanitation. By E. D. Rich. Pp. 678-680.
10. Full-Time Health Service and Travel Safety. By K. E. Miller. Pp. 680-682.

M *Canadian Engineer*
October 19

8. Progress in Sanitation in Ontario. By A. E. Berry. Pp. 13-15.

P *Public Works*
October

47. Solving a Difficult Problem in City Development. By P. L. Brockway. Pp. 12-14.
48. Ocean Outfall Sewer Construction by Oxnard, Calif. By E. O. Imus. Pp. 23-24.
49. Industry Uses the Putnam Process. By R. Blair. Pp. 39-40.

De-Salting an Artificial Island

The 400-acre man-made island in San Francisco Bay which will be the site of the 1939 Golden Gate International Exposition is to be given a series of baths. With a $1,500,000 horticultural program planned, Exposition officials must unsalt the sand of the island, which was reclaimed from the bottom of the bay, before trees, shrubs and flowers can be planted.

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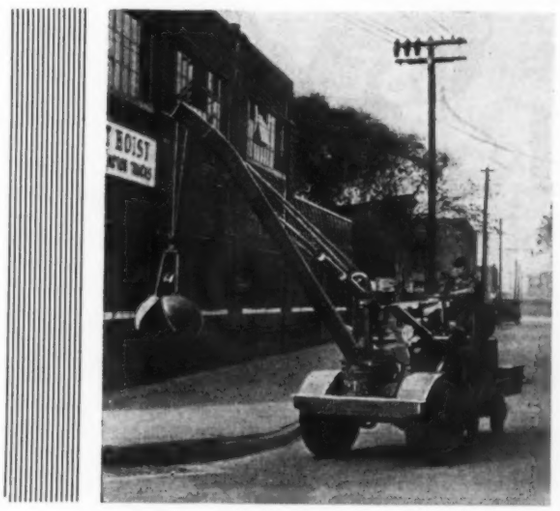

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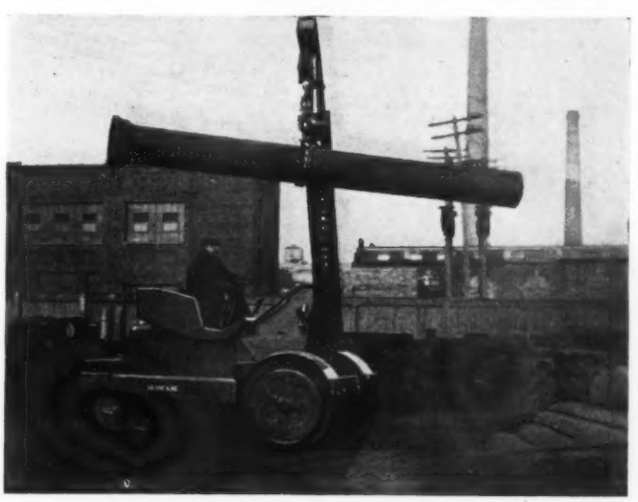

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Sanitation Work by City Held a Governmental Function

The Texas Court of Civil Appeals, Jones v. City of Texarkana, 100 S. W. (2d.) 198, states it as a general rule, with but few exceptions, that a city in constructing a sewer is not engaged in a governmental function, and hence is liable for the negligence of its agents, servants, and employees which result in personal injury to an employee. But the cases make a distinction between the construction of a sewer and work of sanitation for the preservation of the public health, for which there is no liability on the part of the city. Instances were cited where the employee injured was engaged in spraying a disinfectant for the preservation of the sanitary condition of the city and where the employee was engaged in cleaning out a sewer pipe for the same purpose. In these cases it was held that the employee was engaged in a governmental function and that the city was not liable.

In another recent case, City of Munday v. Shaw, Texas Court of Civil Appeals, 100 S. W. (2d.) 765, it was held that where an employee of the city's sewer department was killed while transporting by motortruck to the place of burial the body of a dog killed by the city marshal, the city was engaged in the governmental function of sanitation and not liable for the death. One judge dissented, on the ground that the employee's act was not distinguisable from the removal of garbage, which that court as well as some other jurisdictions, hold to be a proprietary function.

Compulsory Reference of "Long Accounts" in Suit for Extras

In the course of constructing a sewage disposed plant for a municipality, the contractors claimed to have encountered in the work of excavation a stratum of water-bearing sand which made it necessary to furnish sheet piling, pumps, extra labor, and to do an amount of excavation in excess of contract requirements. The contractors sued the city for an amount claimed to be due for these items. The city claimed that a trial would require the examination of a "long account" and that a reference was properly ordered by the trial court under New York Civil Practice Act, § 466.

On appeal the New York Appellate Division, Hemmerich v. City of Geneva, 265 N. Y. S. 660, held that no "long account" was involved although the amount sued for was to be gauged by figures requiring proof of cost data relating to various items of extra labor and materials. These items were items of damage only and not to be considered as an account. A compulsory reference of the issues without the contractor's consent was therefore held not authorized by the statute.

SEWAGE AND REFUSE DISPOSAL AT DOVER, DEL.

A COMBINED sewage treatment and refuse incineration plant has been in operation in Dover, Delaware, since July 24, 1936, and data concerning its operation are available. The population contributing to the sewage plant is estimated at 4,000 and that from which garbage and refuse is collected at 5,000.

The plant is at the southeast end of the city, within 300 ft. of dwellings and 1,000 feet of the state capitol group of buildings. The sewage plant, for primary treatment only, consists of a mechanically cleaned grit chamber and bar screen, pumping station, two settling tanks with "Straightline" sludge collectors, separate

sludge digestion tank with Downes floating cover and heated, and glass-covered sludge bed; cost $78,000. The incinerator is of the Morse-Boulger type, rated capacity 20 tons in 24 hours of refuse, screenings, grit and scum, the mixture burned to contain at least 35% combustible and not more than 50% water, costing $29,000.

The plant is generally of design which is more or less standard. Sludge from the settling tanks is pumped to the digestion tank by a plunger pump driven by a 5 hp. motor, and flows by gravity onto the sludge bed. A chlorinator and copperas dry feeder are provided to furnish ferric chloride, but has been used only experimentally.

Although the floating cover is of the usual design, it has been used in an unusual way and one not advocated by the manufacturers, in that gas is stored under the cover, without any ill effects on sludge digestion or the mechanical operation of the cover. Last winter the gas-fired hot water boiler maintained the temperature of the digester at an average of 87° (84° minimum) and that of the building at 72° during the day. The boiler is operated at 140° to 180° to prevent condensation and resulting corrosion, the hot water to the heating coils in the digester varies from 102° to 108° and the return water from 84° to 92°. The gas collected averages 0.79 cu. ft. per capita per day, weekly averages varying from 0.49 to 1.62 cu. ft. The weight of the floating cover is increased by adding 2,000 lb. of sand in bags, and the gas pressure is 7¾ inches at the digester and 3 inches at the burning rod of the boiler. The rate of gas production has been greater at night than during the day.

The pH of the raw sludge as it reaches the digester is 6.1 to 6.2. No gas was produced until the pH had been brought up to 7.4, which was done by adding lime —25 lb. a day at first, increasing to 75 lb. the third month. Also, during this third month supernatant was withdrawn and city water with a pH of 7.8 was added. After gas began forming the lime dose was gradually tapered off to 12½ lb. per day, and since February no lime has been added and the pH of the sludge ranges from 7.4 to 7.6. The plant operator finds that he can control the pH by adding a combination of lime and city water and manipulating the quantity of supernatant in the tank.

The grit and sludge collectors are operated by motors. Test runs of these in October showed that the 2 hp. motor that operates both sludge collectors used 0.24 kw. input for each or 0.26 kw. for the two together, or 0.116 hp. output at the motor shaft for one tank and 0.132 for both together. The 1 hp. motor operating the screenings and grit remover used 0.34 kw. input or 0.337 hp. at the motor shaft.

In the incinerator, garbage is charged onto a hearth or fire clay arches, where it is burned by hot gases from rubbish burned on iron grates, which gases pass over and under it. No auxiliary fuel has been used since the first ten days of operation. City regulations require that all garbage be drained and wrapped in paper. Collections are made five days a week. Garbage and rubbish combined average 2.79 lbs. per capita per day. The residual ash averages 6.5% of the refuse burned. The average burning rate has been 1.33 tons per hour or 60% above rated capacity. The furnace has been operated an average of 7.35 hrs. a day. The average temperature has been 1390°F.

The above information is abstracted from a paper before the Maryland-Delaware Water and Sewerage Association by Francis S. Friel, of Albright & Friel the engineers for the plant, which was a WPA project.

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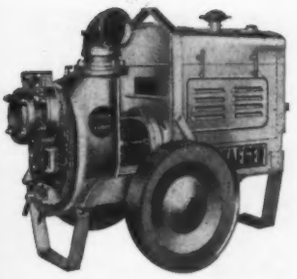

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Widening with 4-wheel-driven truck on Route 20

A well-plowed highway—Route 2, Arlington, Mass.

Massachusetts Highways Kept Safe in Winter

By J. E. LAWRENCE

Maintenance Engineer, Massachusetts Dept. of Public Works

SNOW fall in Massachusetts totaled less for the winter of 1936-1937 than for any year since records have been kept. But though the cost of plowing was therefore small, the cost of sanding the highways to make travel safe was much greater.

Sanding is a much more important feature of winter highway maintenance than it was considered a few years ago. It is realized that opening a road to traffic is not enough—it must, as far as possible, be made safe for such traffic. And a road covered with smooth ice, especially on a hill, is not safe.

Last winter, most of the storms in this state came in the form of rain falling during below-freezing temperatures and freezing at once to a sheet of ice. But icy surfaces also result from the packing, freezing and thawing of the more or less thin layer of snow left on the pavement by the snow plows. The ideal plowing would remove *all* the snow, leaving a clean pavement. This ideal can not be fully attained, but the effort is made to select such plows and so operate them as to reduce to the least practicable minimum the amount of snow left on the pavement. This not only reduces hazards to traffic but also reduces the cost of sanding.

Our winter program covers a total of 1,965 miles of road, of which 1,762 miles are State highway and 203 miles are Town roads maintained on a cooperative basis. The program includes providing an adequate amount of the proper equipment (which is overhauled, painted and repaired during the summer), organizing a force of men to use it, a method of getting them into operation at once when their services are needed, and of keeping informed at headquarters of conditions on each road and the equipment working there.

The State is divided into seven districts and each district is divided into several maintenance sections, each about 30 miles long and in charge of a foreman who works under orders from the district maintenance engineer. The State Department receives daily weather forecasts from the Weather Bureau, and when a severe storm is predicted the district maintenance engineers are informed, also the shop superintendent at the State garage.

As equipment for snow removal, the Department has 141 four-wheel-driven trucks equipped with various types of plows, 5 ten-ton tractors and 18 five-ton to six-ton tractors (the tractors being used only as emergency units); also 120 1½-ton maintenance trucks used as auxiliary plow units, mostly for light plowing and on ramps at grade separations. The 6-ton and 8-ton trucks are equipped with one-way plows for patrol and widening work, and also with interchangeable "V" plows which can be installed in approximately twenty minutes and are used where snow is drifting badly and threatening to block the road.

The newer trucks are equipped with special electrical systems, air brakes, oil steering, the latest oil hydraulic system for operating plows and bodies, hydraulically operated plow wings; also with weatherproof heated cabs and conveniences for the operators such as sleet eaters. These convenience items are worth much more than their minor cost, as they keep the operator in such condition as permits him to operate the truck at its maximum efficiency. The electric plant operates 3 cluster lights, 2 tail lights, a body light, a large red warning or sanding light and in many cases lights directly above the sand spreader, operated on a 12 to 16-volt system.

The sand is treated with calcium chloride and stockpiled in the fall. Providing a shelter for the sandpiles —a tent-shaped structure of lumber and tar paper that two men can lift—has been found well worth while.

After roads have been plowed, all drainage structures are cleared to provide a runoff for melting snow —not very expensive work, but very essential, especially when there is thawing during the day and freezing at night.

During the past year the Department has erected approximately 54 miles of snow fence where past experience has shown the need of it to prevent drifting.

Economy in Ice Control

By C. D. LOOKER
Director of Research, International Salt Company, Inc.

FOURTEEN years ago a prominent highway official questioned the advisability of spending more than $50 per mile in attempting to keep the main roads open to wheel traffic in heavy snow regions, and he was not alone in the opinion that the amount of traffic did not justify greater expenditure. Today the question is being answered by most highway departments in the country by keeping an ever-increasing mileage of roads open for all-year-round use of automobiles, for they consider it good business, not only because of increased revenues from gasoline taxes but also from other normal business as well. In fact, this is considered desirable for the less traveled roads as well as for the main highways.

Snow-plows are used to open drifts in the road and remove the bulk of the snow throughout, but usually leave a thin layer of snow to become compacted by traffic and frozen to ice with lowering temperature. This creates a condition that not only causes decreased speed but also makes winter driving a hazard unless the surface is so treated that it will offer resistance to skidding. This is only one of the many causes for icy pavements. The first snow that forms on a road may melt as fast as it falls until the road surface becomes cold enough to permit freezing, giving a glare of packed snow and ice before the motorist is aware of it. Perhaps the most treacherous condition results when the snow turns to rain and all the slush is not removed before the temperature falls below the freezing point. Last but not least is the ice sheet formed by rain freezing to the road surface as fast as it falls.

Various methods have been tried to control the surface of icy highways, entirely remove the ice, or prevent its formation. Railroads and street car companies have tried heating with oil, gas and electricity. Some highway departments have tried oil burners. Some are using heavily lugged wheels and cutters to break up the ice, after which it is removed by the snow-plow. Others have tried the application of heated sand but most have given this up because they found it highly impractical. It is generally believed that the use of chemically treated abrasives is the most practical and economical means of keeping ice-coated highways safe.

Salt has been used for ages to melt ice but it is only within the past few years that it has been used extensively with the abrasives for treating icy pavements. Rock salt of ice cream salt size, known commercially as CC grade, has been found to be most convenient and economical in this country. It is either mixed with gritty material, mostly sand and cinders, when these are being stored in piles, or it is spread over the surface of the

Treatment with rock salt and abrasives has made this hill safe

piles before freezing weather, allowing rain and snow to take it into solution to coat the abrasive particles and keep the water they contain from freezing. There is no uniformity in the methods of using salt; each highway division works out its own methods depending on local conditions and preferences. These have been so thoroughly described in the literature for treated abrasives that no general description will be given here.

One reason for treating abrasive piles is to maintain the moisture they contain in a fluid, unfrozen condition. Abrasives stored in the open invariably become wet. Those stored under a cover should be moistened before they are applied to the ice in cold weather; otherwise, they will not bond with the ice or become embedded. Since salt solutions evaporate less rapidly than plain water, salt-treated abrasives do not dry out readily below the optimum moisture content for best results. It has been found by repeated tests in some of the most Northern States and Canada that salt in the quantities customarily used by highway departments for chemically treated abrasives does the job most effectively.

Another reason for treating abrasives is to conserve material. It has been demonstrated repeatedly that it requires fewer salt-treated abrasives than untreated abrasives to do an effective job. This is because the moist brine-coated particles bond to the icy surface by freezing in extremely cold weather or become embedded by melting the ice directly in contact with the abrasive, and subsequent alternate melting and freezing enable the gritty material to become firmly anchored in the surface of the ice, thus preventing traffic and wind from removing them.

Cold, dry abrasives will not adhere to or become frozen in the surface of dry, cold ice. Cinders hauled directly from the furnace room have not proven satisfactory when hauled long distances and distributed without chemical treatment. One highway department is treating such cinders with eutectic salt brine (23.3 per cent) immediately before application.

In extremely cold weather, brine tends automatically to adjust itself to the eutectic composition, which begins to freeze at minus six degrees Fahrenheit. This does not mean that an abrasive pile will freeze up when the prevailing air temperature has lowered to minus six. In the first place, an abrasive pile is a good insulator and the temperature on the inside averages much higher than the usual prevailing air temperature during sudden drops in temperature. Furthermore, a thin coat of ice over the surface of a pile of grit provides further insulation of the interior. For protection at temperatures lower than minus six degrees, the moisture on the abrasives must contain a greater percentage of dissolved chemical than the 23.3 per cent mentioned above.

Rock salt does not dissolve so rapidly that the usual fall rains will cause undue leaching from the abrasive pile. Consequently, an ample supply is present if the heaps have been covered with the desired quantity of rock salt or those treated integrally are capped with a few pounds to maintain high strength of brine in the surface. When more salt is used than sufficient to make a 23.3 per cent solution, the excess acts as a reserve against dilution of brine by rain or melting snow.

Chemicals are not used generally to melt ice from highways, but for melting ice they have application for certain purposes such as keeping gutters, catch basins, safety zones, sidewalks, bus stops, street car switches, etc. free from ice. For such purposes a thin spread of rock salt will often keep sleet from forming on a road surface or melt it after it has formed and prove more economical than abrasives. Salt-treated abrasives are more satisfactory and economical for all conditions that produce ice or packed snow that is thicker than a very thin layer.

As a rule, traffic produces considerable packing of snow on the pavement in advance of snow plowing. The plow does not usually break the bond between this packed snow and the pavement but leaves it there to create a slippery hazard. One division in Ohio overcomes this difficulty by a timely use of rock salt. By paying close attention to weather reports as given by air lines and the local weather bureau and by frequently referring to barometers stationed in State garages, the division office in connection with the county superintendent in charge of maintenance, can fairly accurately anticipate the arrival of snow, and it is a standing order that, as soon as snow starts falling, trucks loaded with salt and equipped with spreading devices begin spreading salt on designated roads in advance of snow plowing. From ¼ to ¾ pound of salt per square yard of road surface is used, depending on conditions. Spreading is continued until all roads are covered or until the depth of snow is approximately three inches. If the salt is placed before the snow reaches a depth of three inches, it has been found that most of it will remain on the road in the thin layer of snow left by all snow-plows. It is then that traffic or another pass of the snow-plow is successful in breaking the bond of the snow to the pavement and stopping the formation of matted snow or snow-ice on the pavement, so that all snow is plowed completely off the pavement and deposited well out on the shoulders to prevent meltage on the traveled road surface.

Within 24 hours after the heavy snow-storm of January 2, 1936, both the Dixie Highway and National Highway through this division were free from ice and snow, and traffic traveled on dry pavements in spite of temperature ranging as low as 28 degrees below zero. Other roads in the same localities were not passable for a much longer time.

Damages for Default and Delay

The contractor for the construction of a water supply tunnel for a city gave a bond under which the city had the right to complete the work on default of the contractor and charge the expense thereof to the contractor or his surety. The contractor defaulted and the city obtained another contractor to complete the work. The city after completion sued on the contractor's bond for damages. The Federal District Court for eastern Pennsylvania held, City of Reading v. United States Fidelity & Guaranty Co., 19 F. Supp. 350, that the bond was one of guaranty and not merely of indemnity, so that the surety's liability became fixed immediately on default. The city could therefore sue on the bond without waiting for actual loss to accrue. The measure of damages was held to be the difference between the first contractor's and the second contractor's aggregate prices. It was held immaterial that the contracts contained unit instead of lump-sum prices. The units being ascertainable, the prices were readily reducible to a lump-sum basis.

The city also claimed damages for delay of 13 months from the date stipulated for completion in the first contractor's contract to the date of actual completion, on the basis of $50 per day penalty for delay contained in the contract. The city was held entitled to damages at that rate directly resulting from the default, but not to exceed four months, the period within which the second contractor guaranteed to complete the work.

Snow Fighting

(Continued from page 11)

Lifts, Controls and Attachments

For routine snow plowing, trucks are used at a relatively high rate of speed. This high speed requires a quick and sure control of the plow, and in heavy-duty work, control by hand and mechanical equipment is slow, cumbersome and arduous. Furthermore, snow removal is hard work, in that plow operators must remain on the job for many hours in the most severe weather, and handling a heavy truck under these conditions taxes even the most rugged operator. To make men and equipment as efficient as possible, hydraulic controls are desirable. Their use means increased safety, greater comfort for the truck operator and increased amount of work performed. Such controls should be reliable; breakdowns at critical moments may put out of use a piece of equipment that is vitally needed. They should be fast, so that a plow or wing can be raised rapidly enough to avoid reducing truck speed. They should be convenient, so that the operator can handle it without fatigue and in the comparative comfort of the truck cab.

Vickers hydraulic control units. The cut shows two single- and one double-acting units, without integral relief valve.

Vickers manufacture hydraulic control units for snow plows, which units consist essentially of an oil pump, a few feet of tubing, a valve bank and cylinders. Such an installation provides for any desired combination or sequence of motions. Wear is negligible; cold weather does not affect the operation. Power is normally obtained from a power takeoff (though hand pumps also can be provided).

Most plows are now available with hand or power hydraulic controls. Plows not so equipped can be changed over and brought up to date easily and with little expense.

Sidewalk and Crosswalk Plows

There are few forms of municipal activity more greatly appreciated by the residents of cities in the snow belts than plowing snow off sidewalks. A good plow and a small tractor can clean the sidewalks over a large area before breakfast. This helps in getting children to school on time and is a safety measure in that they are not obliged to walk in the streets at a time when the traffic is heavy. Also, sidewalk plowing saves a good many blisters and lame backs on the part of residents.

These small plows are also handy for

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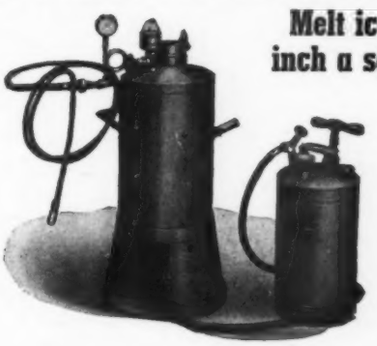

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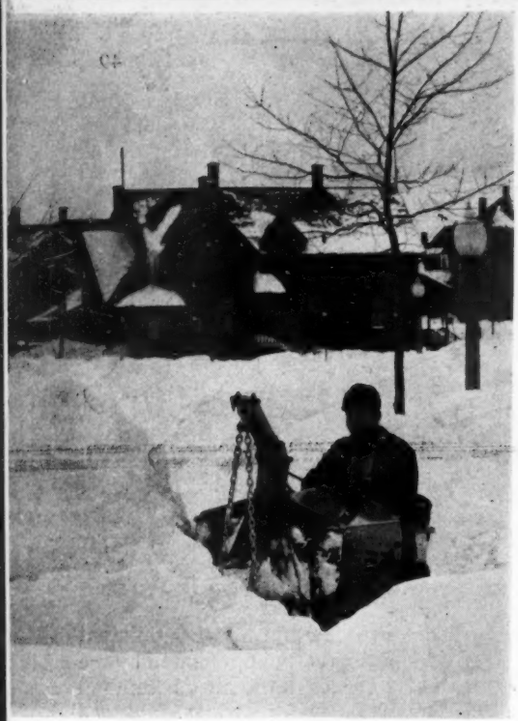

Small Cleveland tractor plowing sidewalk

other municipal uses, as in parks and around municipal buildings. Somewhat larger plows are also made—too large for sidewalk use, where the width is severely limited—but adaptable to parks, playgrounds, airports, etc., for which there are many uses in the average city.

Frink makes a sidewalk plow (also handled by Davenport-Besler, which is of V-type, cutting to a width of 5 ft. The extreme moldboard spread is 7 ft., the nose height 2 ft. and rear height 4 ft. This can be raised by the driver's feet so as to clear a 14-inch obstruction.

Gravely has a small sidewalk power-driven snow plow that will clear pretty nearly any of the sidewalks in the residence districts without getting caught in trees or other obstructions. It will clear from 40 to 54 ins. wide, being adjustable to the desired width. This machine is especially handy because the small tractor on which the plow is mounted (which is furnished by Gravely) serves as a power lawn mower during the summer. For winter work, the mowing attachment is removed and replaced with the snow plow.

Meyer makes a very considerable assortment of small plows for sidewalk, crosswalk, park and other light plowing. These can be mounted on the smallest trucks, on passenger cars, or on small tractors with narrow tread for sidewalk and similar work such as are furnished by Cleveland Tractor or International, also by several other manufacturers. Meyer furnishes both V and blade plows and has developed a special rubber-edged squeegee blade for sidewalks.

Good Roads makes both blade and V plows for sidewalk work. The former has a reversible blade, and standard equipment includes hydraulic lift and safety blade trip on both types. The blade plow plows from 5 ft. wide to 6 ft. 4 ins.; the V plow clears 6 ft. wide. These are designed to work with small tractors.

Zaremba has a junior snow rotor consisting of a small garden tractor carrying one 24-inch rotor with the operator either walking behind the tractor or carried on a riding attachment. Centaur Tractor also has both reversible blade and V plows for mounting on their light and narrow tractor. Bros builds blade plows for light trucks and passenger cars.

Most of these same units are used for clearing cross-walks, but if streets are plowed, crosswalks do not need much additional clearing, if any. They are also used for clearing parking spaces, around filling stations, factory yards, etc. Tractors equipped with bulldozers are often used for this work, and a few special push blades have been developed which somewhat resemble the bulldozer but are of lighter construction.

Motive Power Equipment

Tractors, both heavy and light, and trucks, find economical employment in snow removal. For the rural highways, fast trucks are best adapted to the patrol system, and the heavier trucks and tractors for heavy-duty removal.

Allis-Chalmers crawler tractors are made in a large variety of sizes for use with the heavy V plows. Baker makes a line of tractor snow plows particularly designed for use with the various A-C tractors. The L-O is an oil burning tractor that starts like an automobile, by pushing the starter—an especially desirable feature in snow plowing. The Baker 241 V plow with a cutting width of 12 ft. (with wings extended 23 ft. 6 in.) is designed for this unit. The 241 plow weighs 10,000 pounds without wings.

Case wheel tractors have pneumatic tires. The Case heavy-duty 4-speed special has dual 11.25 x 28 tires, with speeds from 1.32 to 14.35 miles per hour. These tractors use a plow mounted close to the radiator; hand or power controls are available. They are suited for rural highway or city street plowing, using the V plows, with or without wings, the one-way, or the reversible. A narrow-tread tractor is available for sidewalk plowing.

The Linn tractor is unique in that it is both a truck and a tractor. The conventional rear wheels of the truck are replaced by a crawler unit. Developing enormous tractive power at low speeds, the Linn can travel as fast as about 12 m.p.h. The truck body permits its use for hauling very large loads and for all sorts of heavy work. Frink has designed the Linn-Frink V plow especially for use with this tractor. With wings open, plowing width is 21 ft.: without the wings it is 11 ft. 8 in.

Rotary Plows

Rotary plows are suited for the heaviest snow removal conditions, such as deep drifts, and for widening especially where there are high banks. The rotating blades pick up the snow and throw it clear of the road—most rotary plows will throw snow to either the right or the left, or will pile near at hand or load into a truck. This makes them useful also for certain types of city work. Klauer makes one model,

Courtesy Carl Frink

Method of using wings

Allis-Chalmers "L" tractor with Wauson plow

which is designed for "every kind of snow removal work." Zaremba makes three models—the "battleship" for heavy duty highway operations; the cruiser model for cleaning city sidewalks, etc., and a junior model for still lighter work.

Desirable Factors in Snow Removal Equipment

Snow removal must be done under difficult conditions, including severe weather, heavy work and long hours. The last is necessary both because of the lack of enough skilled men to handle the plows, and also because of the inability to relieve them at the end of an 8-hour shift, if the plow is several miles out in the country where it may be difficult for the relief crew to locate it. As noted in *Public Works* several months ago, at least one county has equipped its snow plows with short-wave radio as a better means of control and for keeping in touch with the work.

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The matter of hydraulic hoists has already been mentioned. In addition, trucks or tractors for snow removal purposes should have the following: *Electric starting*, since engines may be stalled in a drift, and getting out and to the starting crank then becomes a major problem. *Comfort for the operator*, which can be attained with a stormproof, heated cab, with comfortable seat and arm and back rests. Plenty of vision is also required. *Easy controls* so that the whole machine responds quickly to the operator's will, and without undue or heavy mental or muscular strain. Other desirable factors are good road clearance, positive traction, and plenty of lights. Head and tail lights, both red and white, and spot lights contribute to safety of motorists and of equipment.

Removing Ice Ruts and Breaking Up Ice

Several pieces of equipment are available for ripping heavy layers of ice off the streets. Gifford-Wood has an ice rut remover that consists of a bar carrying cutting teeth, which bar is mounted on adjustable steel runners. These runners are spaced 4 ft. 11 ins. apart, just right to fit into ruts made by automobiles. The machine is towed by a tractor or truck, the teeth being set so as to scarify and rip up the ice. Depth of cut is regulated by hand wheels. An operator rides on the machine. Speed of operation is 3 to 5 miles an hour, and the ice is cut to within 1½ inches of the pavement.

Above, Case tractor handling a V plow in heavy going

Beach has a road conditioner, primarily designed for smoothing gravel and similar roads, that has been used for ice removal very effectively. This unit can be attached to a tractor-pulled grader or to a motor maintainer or grader, since it can be attached to any grader or spring scraper.

When ruts are deep, the use of this type of equipment followed by the application of calcium chloride or salt is most effective. After the chemical has honeycombed and lossened the ice, it should be removed, which may be done effectively with a grader, bulldozer or snow plow.

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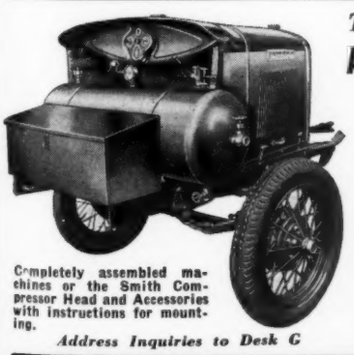

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A New Refuse Body

By ARTHUR K. AKERS

THERE are certain basic requirements for a refuse collection vehicle. These include: 1. A large payload per truck, since it is not possible, in modern cities, to have the disposal area near the center of the community and a large capacity body avoids the necessity for frequent trips to the incinerator or the dump. 2. An enclosed body, so that paper and other debris will not fall or be blown from the collecting vehicle, adding to the litter on the streets. 3. A low loading height, so that the collectors are not injured physically by the work of lifting heavy cans or boxes. It is doubtful if any other kind of work is so apt to cause ruptures and hernias as the continued lifting of heavy loads to an excessive height. Refuse collectors have suffered especially from these disabling injuries.

A new type of refuse body—the Silentpack—has been announced and tried out. The features of this body, which is totally enclosed, are large capacity and low loading lift. By means of a compacting impeller within the body, refuse is compressed to a half or a third of its normal volume, thus increasing the capacity markedly. This arrangement permits discharge of the load through the end, eliminating the need for extra head room for dumping—an important feature at many incinerators.

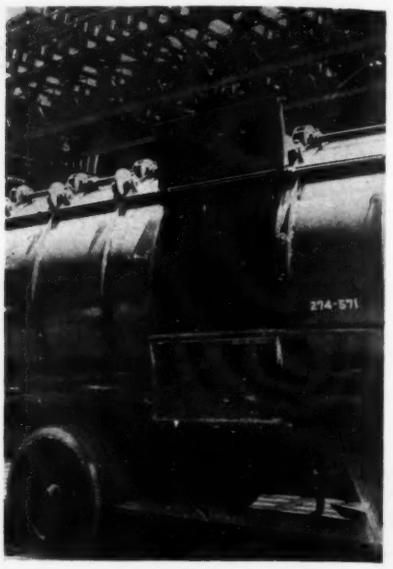
This body consists of a cylindrical tank within which is an impeller operated by means of gears through a power take-off from the truck engine. By means of this impeller, a pressure of about 800 pounds per square foot is available for compacting the refuse. This can be set for a predetermined pressure, and when this pressure is reached the power take-off snaps into neutral. Dumping or unloading is accomplished by this same means. The tailgate latches are released, the tailgate swings free, and the impeller forces the load out as shown in the accompanying illustration.

A loading door is placed at the forward end and on each side of the body. This is equipped with a counterbalance for easy opening, but locks securely. Refuse is dumped into the door opening until it is well filled; the doors are then

The compressed load is forced out of the end of the body

shut and the material pushed back out of the way with the impeller.

For the average 5-ton or 7½-ton truck, the body is about 6 ft. in diameter and 15 ft. long, of which about 3 ft. are not available for loading. This leaves about 12 cubic yards of space for compressed material, equivalent to about 30 cubic yards of loose refuse. At the top is a platform for placing bulky pieces, too large to go into the body proper. The entire weight, exclusive of the truck is about 8,000 pounds.

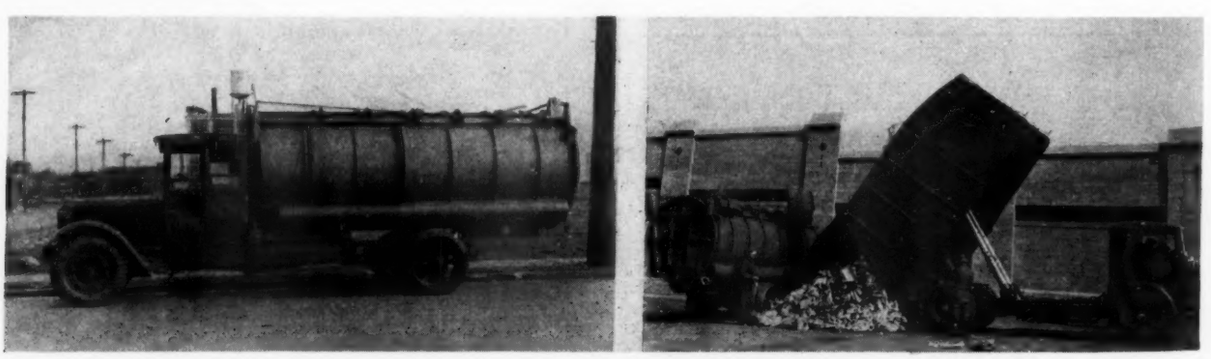


The loading height is low

The low loading doors and the broad running boards facilitate easy loading. The compaction feature is designed not only for the greater capacity obtained, but also to crush and break up boxes, barrels, furniture, etc., which, when done by hand, is not only time-consuming but also results in many minor injuries to the workmen, as scratches, and from nails and splinters.

Below is shown an illustration of one of these units beside a 24-yard refuse body both of which are used by New York City. The 24-yd. body, which was completely filled, was dumped, and the entire volume was then hand-shoveled into the Silentpack body shown, and compacted to less than one-half of its original volume. This illustration shows also the difference in head room required when dumping.

These bodies will be manufactured in several sizes to meet with the requirements of large and small municipalities. The Silentpack body is a product of the Silent Hoist Winch & Crane Co. of Brooklyn, N. Y.

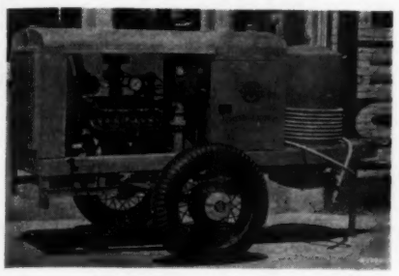


The view at the left shows the refuse body mounted on a department truck; at the right is shown comparative capacities of two types of bodies, and relative dumping heights

Keeping Up With New Equipment

High Speed Portable Air Compressor

The W-K Manufacturing Company, Kansas City, Mo., has announced a light weight compressor for all types of construction work using pneumatic tools.



W-K portable air compressor

There are two sizes available in W-K compressors, 70 and 140 cu. ft. actual air delivery. Two Ford V-8 engines are used in the construction of the larger 140 cu. ft. compressor while in the 70 cu. ft. machine only one V-8 engine is used. One bank of the V-8 is used for power cylinders and the other bank is utilized for the W-K air head and valves.

W-K compressors are designed for portability and may be towed behind an automobile at speeds up to sixty miles per hour. The "Quick-way" snapon towing hitch makes it possible to attach compressor to automobile ready for towing in one minute.

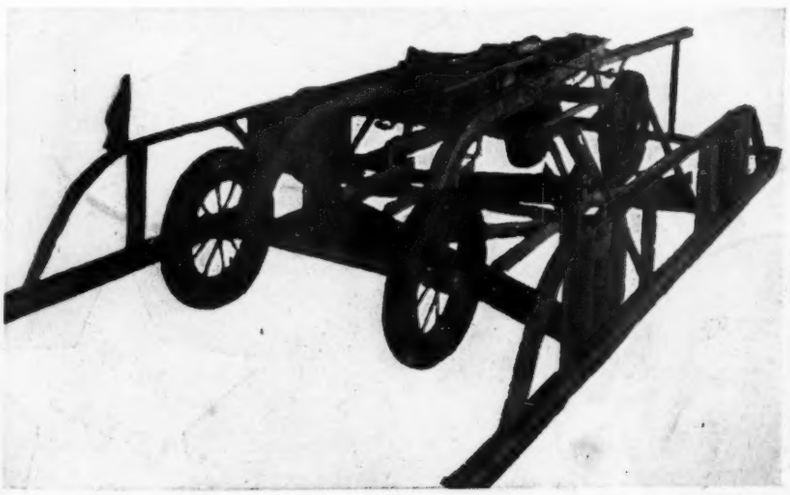
The Allen Road Maintainer

A new type of road machine has been developed by the Allen Road Machinery Corporation, Shreveport, Louisiana. The machine is said to do perfect work at speeds up to 20 miles per hour. It is recommended for any type of bladeable road, such as dirt, gravel, crushed stone, shell, sand and caliche, for laying black top and oil mat, and has a scarifier attachment for preparing and shaping oiled roads for reshooting.

The automatic control is an important feature, the blade setting being controlled by the draw bar pull without changing the contour or crown of the road for which machine has been set by the operator. It is not necessary to lift blades when crossing bridges, culverts, etc., or when turning.

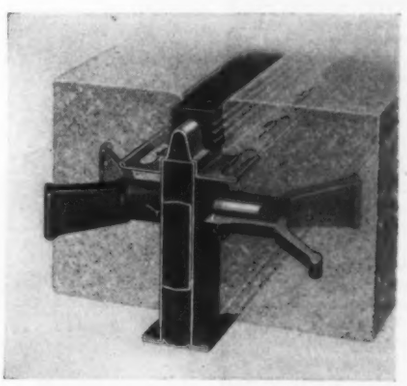
The construction is entirely of standard angle and "I" beams electrically welded together. Timken roller bearings in the wheels, regulation drop center rims and balloon type low pressure tires are standard equipment. It can be transported from one job to another at 60 miles per hour by automobile or truck.

It is built in two sizes. The standard machine is 7′ 6″ wide, weighing 2100 lb., requiring any 1½-ton truck or farm tractor to operate, and the Deluxe machine 10′ 6″ wide, weighing 3500 lb., which calls for a four wheel drive or a 3- to 5-ton rear wheel drive truck, or industrial type rubber tire tractor.



The Allen Road Maintainer

The "Quick-Way" truck shovel may be mounted on any 3½ to 5-ton single axle truck having dual pneumatic or hard tires in the rear. No weights or counterbalances are needed. Gasoline powered; 0.4-yd. capacity bucket; weighs 5½ tons; highly mobile; fully convertible. Excellent folder from Quick-Way Truck Shovel Co., Denver, Colo.



The J-Bar is a simple and highly efficient device for carrying loads across expansion and contraction joints. Installation is simple. Write American Concrete Expansion Joint Co., Chicago, Ill., for details.

Highway Safety Stop Sign

A through highway safety stop sign which is plainly visible to the motorist since it is located directly in the center of the highway or street, yet presents no hazard to traffic, has been built by the Michigan Malleable Iron Company, Detroit, Mich. The sign is made of malleable iron and is practically indestructible. Installation is made by means of four anchor bolts which fasten it firmly to the pavement. The "stop" flag is hinged and when run over by a vehicle, is pushed against rubber bumpers and so is not marred. When released, the flag returns at once to a vertical position. Four reflector buttons aid visibility at night, and black letters on a yellow background make the sign distinct during the day.

EXHIBITORS LIST

J. D. ADAMS COMPANY
AEROIL BURNER COMPANY
ALLIS CHALMERS MFG. CO.
ALL PURPOSE SPREADER CO.
THE AMERICAN CITY MAGAZINE
AMERICAN CONCRETE EXPANSION JOINT CO.
AMERICAN HOIST & DERRICK CO.
AMERICAN MANGANESE STEEL CO.
ANTHONY COMPANY, Inc.
ARMCO CULVERT MFRS. ASSN.
THE ASPHALT INSTITUTE
ATHEY TRUSS WHEEL COMPANY
ATLAS POWDER COMPANY
THE AUSTIN-WESTERN ROAD MACHINERY CO.
THE BAKER MANFACTURING CO.
BARBER-GREENE COMPANY
THE BARNES MFG. CO.
THE BARRETT COMPANY
BAY CITY SHOVELS, Inc.
BENDIX PRODUCTS CORP.
BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO.
BETHLEHEM STEEL CO.
THE BLACK & DECKER MFG. CO.
BLAW-KNOX COMPANY
BRODERICK & BASCOM ROPE CO.
THE BUCKEYE TRACTION DITCHER COMPANY
BUCYRUS-ERIE COMPANY
THE BUDA COMPANY
THE BUFFALO-SPRINGFIELD ROLLER COMPANY
BUTLER BIN COMPANY
THE BYERS MACHINE COMPANY
C. H. & E. MFG. CO., Inc.
CALCIUM CHLORIDE ASSN.
THE CALHOUN CO.
J. I. CASE COMPANY
CATERPILLAR TRACTOR CO.
CHAIN BELT COMPANY
CHEVROLET MOTOR COMPANY
CHICAGO PNEUMATIC TOOL CO.
CHICAGO RAWHIDE MFG. CO.
CLEAVER-BROOKS CO.
THE CLEVELAND ROCK DRILL CO.
THE CLEVELAND TRACTOR CO.
CONSTRUCTION MACHINERY CO.
CONTINENTAL MOTORS CORP.
CONTINENTAL ROLL & STEEL FOUNDRY CO.
CONTRACTORS & ENGINEERS MONTHLY
THE F. D. CUMMER AND SON CO.
CUMMINS ENGINE COMPANY
D-A LUBRICANT COMPANY, Inc.
DAVEY COMPRESSOR CO., Inc.
DIAMOND IRON WORKS, Inc.
DIMICK-MOSHER PRODUCTS CO.
DONALDSON COMPANY, Inc.
DOW CHEMICAL COMPANY
EAGLE CRUSHER COMPANY, Inc.
EATON MANUFACTURING CO.
EDISON-SPLITDORF CORP.
ELECTRIC TAMPER & EQUIP. CO.
ELECTRIC WHEEL CO.
EMSCO DERRICK & EQUIP. CO.
ENGINEERING NEWS-RECORD
E. D. ETNYRE & COMPANY
THE EUCLID ROAD MACHY. CO.
EVANS PRODUCTS COMPANY
FAIRBANKS, MORSE & CO.
J. D. FARASEY MFG. CO.
THE FATE-ROOT-HEATH CO.
THE FOOTE COMPANY, Inc.
THE FOUR WHEEL DRIVE AUTO CO.
FRUEHAUF TRAILER CO.
FULLER MANUFACTURING CO.
THE GALION ALLSTEEL BODY CO.
THE GALION IRON WORKS & MANUFACTURING CO.
GARDNER-DENVER COMPANY
GENERAL MOTORS TRUCK & COACH
THE GENEVA METAL WHEEL CO.
GILLETTE PUBLISHING CO.
W. S. GODWIN COMPANY, Inc.
B. F. GOODRICH COMPANY
THE GOOD ROADS MACHY. CORP.
THE GORMAN-RUPP COMPANY
GRUENDLER CRUSHER & PULVERIZER CO.
GEORGE HAISS MFG. CO.
HAMILTON MANUFACTURING CO.
HANSON EXCAVATOR WORKS
HARNISCHFEGER SALES CORP.
THE HEIL COMPANY
THE HELTZEL STEEL FORM & IRON COMPANY
HERCULES MOTOR CORPORATION
HERCULES STEEL PRODUCTS CO.

Will Other Contractors Underbid You in 1938?

Yes—if you don't attend th
1938 ROAD SHOW
and CONVENTION

Because—

they will have the advantag
of seeing 6 acres of ne
machinery and material exhibi

They will have the advantag
of hearing 6 days of discussion
of modern highway constructio
methods.

COME TO
JANUAR

It Will Pa

NEW MACHINERY

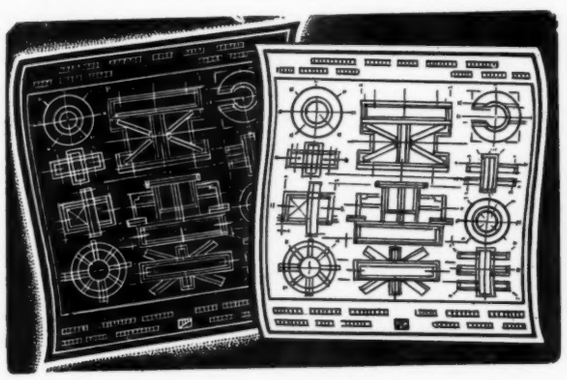
NEW IDEAS

AMERICAN ROAD BUILDERS' ASSN.
ARBA
1902

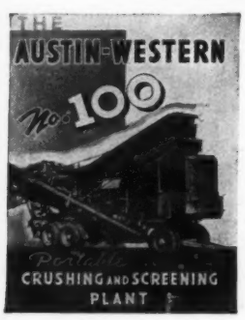
KEEPING UP WITH NEW EQUIPMENT

Making Tracings from Blueprints

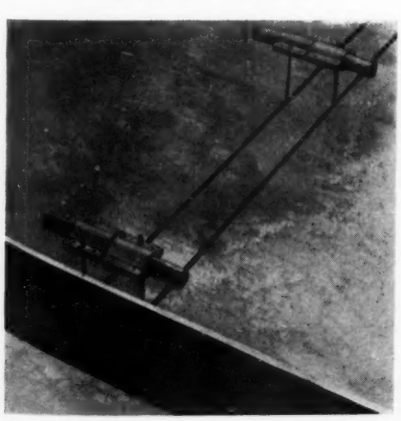
When important tracings have been lost or mutilated, or are not available, a method of reproducing them from blueprints without the tremendous labor of redrawing is certainly worthwhile. The Lake Photoprint Co., 19 So. Wells St., Chicago, Ill., has developed a method of transferring blue prints to tracing cloth, thus providing a new tracing from which an unlimited number of blue prints can be made. Information will be sent on request. The illustration shows before and after.



At right, Koehring 303 Excavator. Below, left, a blue is reproduced on tracing paper. Below, center, cover of Austin - Western crushing and screening plant catalog.



This shows T-G bars in metal expansion joint, set 20" on centers.



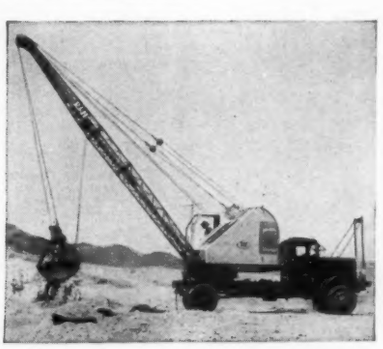
T-G bars set in position ready for pouring concrete.

For Expansion and Contraction Joints

The T-G Bar is designed to speed up highway jobs. Factory assembly saves the trouble of greasing and painting, and eliminates handling a lot of parts. The complete T-G Bar is delivered in two pieces and all that is needed is a hammer to drive these together. One man can assemble all the joints required for any job and keep well in front of the mixer, it is claimed.

All the parts are made on precision dies and every piece is exact. The overall length of the galvanized bearing sleeve, into which the greased ¾" cold rolled dowel is inserted, is 7½" long. The stress-reducers are 2" long and 2¼" across. Thus the unit is compact.

T-G Bars can be used with any type expansion or contraction joint. It may be placed with or without an installer. It is approved by the Bureau of Public Roads and included in many state standards. It is furnished by the Five-Way Expansion Joint Co., 20 North Wacker Drive, Chicago, Ill.



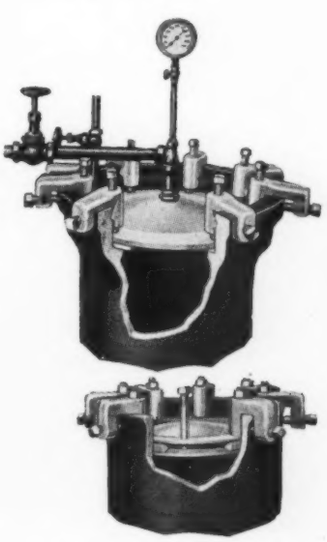
P & H ½-yd. Bantam Shovel used by Bureau of Reclamation

Koehring 303 Excavator

Koehring has a new ¾-yard Shovel —Model 303—high speed, light weight. High strength special steels, welded construction, produce exceptional strength, with a decrease in weight. It is fully convertible, with a 1-yard rating as a crane or dragline. Attachment changes easily and quickly made on the job. A simple gear shift provides two selective swing speeds to best synchronize with the arc of swing and height of lift for increased output. Two traction speeds give greater power in tough going and faster speed in easy traveling. Positive steering for any angle from the lever position in the cab. Full vision from the cab; safety glass; gears are enclosed and run in oil bath; anti-friction bearings eliminate power waste. Koehring Co., Milwaukee, Wis.

Plugs for Testing Pipe

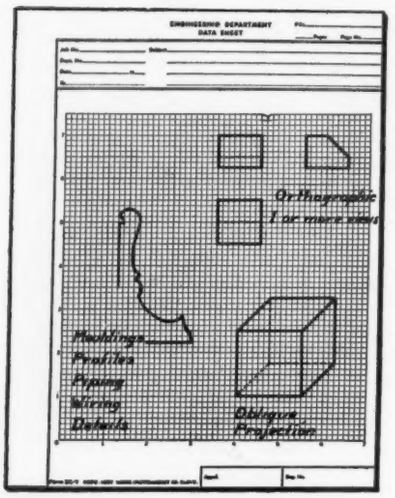
Completing a pipe line calls for testing a main under pressure, and there aren't usually enough valves to shut off the ends, so that a test plug must be used. Test Plug Mfg. Co., Niles Center, Ill., make a plug that consists of a steel plate, a rubber gasket, and the necessary clamps, which can be put in place easily and quickly and is guaranteed against 300 pounds per square inch. Also useful for temporary repairs.



A new plug for testing pipe

Sketch Sheets

These have a 7 x 7½-inch drawing area laid out in ⅛-inch squares with inch lines heavy and numbered on 8½ x 11 sheet. Identification lines are provided. Handy for all types of sketches, records, operations and estimates. Also available with a 7 x 10-inch sketching



Wade Sketch Sheets

area without other printing. Black ink or pencil drawings stand out distinctly and make clear blueprints. The tracing paper will not deteriorate and so can be used for permanent records.

These are made by Wade Instrument Co., 2246 Brooklyn Station, Cleveland, Ohio, who also manufacture isometric and perspective paper that is very handy.

A Catch Basin Cleaner

Owned and operated by the City of Niagara Falls, N. Y., is this model EQ Mack eductor truck of 1500 gallon capacity. Used for cleaning catch basins and manholes, the unit before going to the job is first filled with clean water. This water is pumped into the basin to flush it and then drawn back into the tank by suction hoses. The dirty water is then taken to a nearby sewer where it is disposed of. In flood times this unit is also used to pump out cellars and buildings, and in emergency cases it also serves for street flushing.

News of Engineers

William Raisch, formerly of Municipal Sanitary Service Co., has opened an office as consulting engineer, specializing in sanitation, at 227 Fulton St., New York, N. Y.

Charles D. Bottomley, sanitary engineer of Dorr-Oliver Co., Ltd., London, has returned to England after several weeks in the United States, during which time he inspected many sewage treatment plants and attended the opening of the new experimental plant at Westport, Conn.

Michael J. Blew, research engineer, Philadelphia, Pa., has been promoted to the grade of lieutenant colonel, Sanitary Corps, Reserve, U. S. Army.

Neil Jersey, for the past twelve years sales manager of the W. A. Riddell Co., Bucyrus, O., has been promoted to vice-president and general manager, succeeding the late H. F. Holbrook.

J. A. Hadley has resigned as engineer of the Gibson County, Tenn., Highway Commission, and accepted a position as Division Engineer with the State Highway Department at Jackson. Vernon Wyatt succeeds Mr. Hadley as engineer for Gibson County.

George C. McNutt, formerly advertising and sales promotion manager of R. G. LeTourneau, Inc., Peoria, Ill., has joined Bert S. Gittins, Advertising, Milwaukee, Wisc.

Reeves J. Newsom has resigned as president of the Community Water Service Co. and its forty-three subsidiary operating companies to enter practice as consulting engineer, in collaboration with James C. Harding. Mr. Newsom's offices will be at 500 Fifth Ave., N. Y. Mr. Harding will retain his offices at 11 Park Place, N. Y., and Mt. Kisco, N. Y.

Alexander W. Limont has been appointed manager of the Compressor Division of the Sullivan Machinery Co., Michigan City, Ind.

Neal Higgins has been appointed to head the Industrial Sales Division of the International Harvester Co.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933.

Of PUBLIC WORKS, published monthly at New York, N. Y., for October 1, 1937.

State of New York }
County of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. T. Morris, who, having been duly sworn according to law, deposes and says that he is the Business Manager of PUBLIC WORKS and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Public Works Journal Corp., 310 East 45th St., New York, N. Y.; editor, A. Prescott Folwell, 310 East 45th St., New York, N. Y.; managing editor, none; business manager, J. T. Morris, 310 East 45th St., New York, N. Y.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Public Works Journal Corp., 310 East 45th St., New York, N. Y.; J. T. Morris, W. A. Hardenbergh, Croxton Morris, A. Prescott Folwell, all of 310 East 45th St., New York, N. Y.; Sumner N. Hume, 3564—84th St., Jackson Heights, N. Y.; Wesley Hardenbergh, Golf, Ill.; Anna Morris, Hotel St. Andrew, New York, N. Y.; Estate of S. W. Hume, care of Empire Trust Co., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) Bertha Morris, White Plains, N. Y.; Elizabeth Hardenbergh, White Sulphur Springs, N. Y.; Mary Sunderland, Liberty, N. Y.

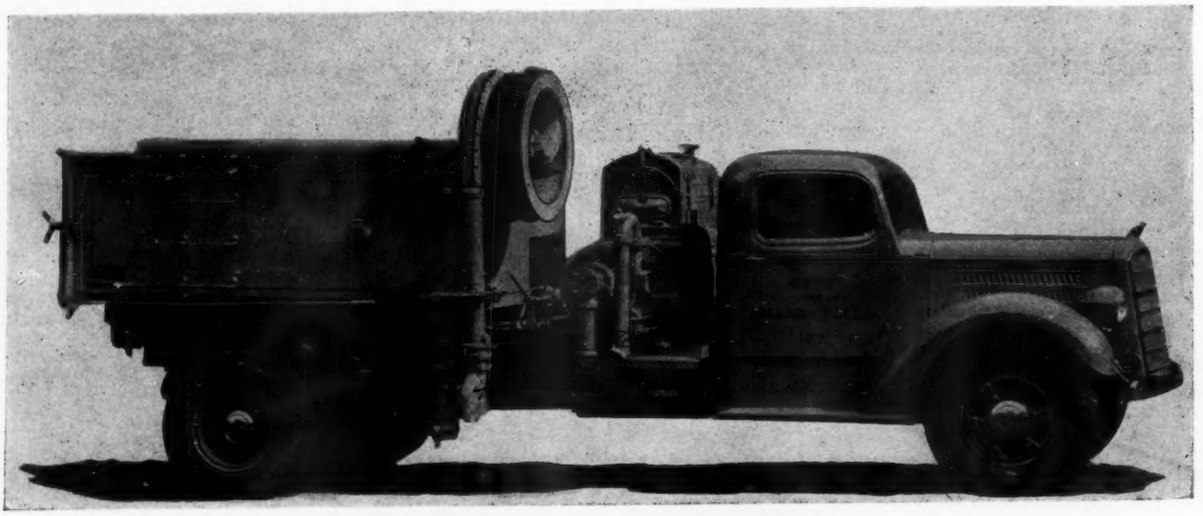
4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is .... (This information is required from daily publications only.)

J. T. MORRIS, Business Manager.

Sworn to and subscribed before me this 6th day of October, 1937.

CROXTON MORRIS
Notary Public, Westchester County, N. Y.
Cert. filed in N. Y. Co. No. 879, Reg. No. 9-M-549
Commission Expires March 30, 1939
(Seal)

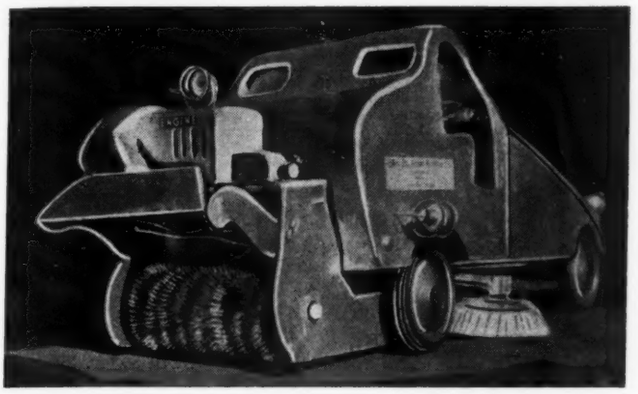


Mack Eductor Truck used by City of Niagara Falls

KEEPING UP WITH NEW EQUIPMENT

Something New in Street Sweepers

A vacuum air-blast sweeper has been developed by the Clean City Sweeper Co., Little Rock, Ark., that is said to operate at speeds up to 25 miles an hour, and to sweep 40 to 60 speedometer miles between midnight and 6 a. m. Many advantages are claimed for this unit, which are described and illustrated in a folder that will be sent on request.

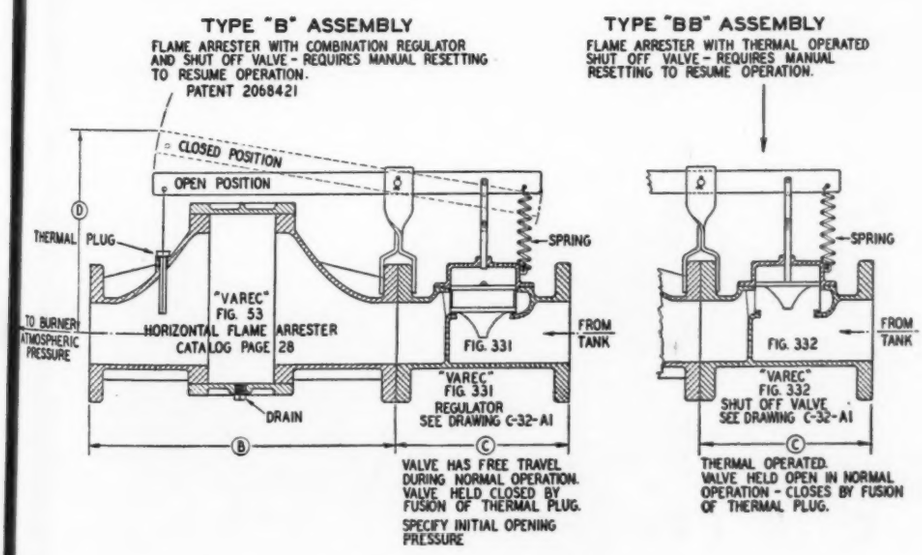


Left: A vacuum air-blast street sweeper

Left: This Walworth valve has a seat ring and disc of 500-Brinel stainless steel. You can flatten a nail between them without leaving a mark. Also non-corrosive.

Varec Flame Traps

Flame traps for sewage treatment plants are offered by the Vapor Recovery Systems Co., of Compton, Calif.; also explosion and pressure relief valves and pressure regulators. The "Varec" flame arrestor is listed by the Underwriters Laboratories and approved by the Factory Mutuals Laboratories. This equipment was originally developed for the petroleum, hydrogen, chemical and coal tar by-products industries. The flame trap is made of a special aluminum, non-corrosive and high in thermal and electrical conductivity, which does not buckle under fire exposure; and Factory Mutuals tests prove that it will stop explosion, withstand continuous flame exposure in open or closed areas and rapidly dissipate heat to the atmosphere.


TYPE "B" ASSEMBLY
FLAME ARRESTER WITH COMBINATION REGULATOR AND SHUT OFF VALVE - REQUIRES MANUAL RESETTING TO RESUME OPERATION.
PATENT 2068421
CLOSED POSITION
OPEN POSITION
THERMAL PLUG
SPRING
"VAREC" FIG. 53 HORIZONTAL FLAME ARRESTER CATALOG PAGE 28
TO BURNER ATMOSPHERIC PRESSURE
FIG. 331
FROM TANK
"VAREC" FIG. 331 REGULATOR SEE DRAWING C-32-A1
DRAIN
VALVE HAS FREE TRAVEL DURING NORMAL OPERATION. VALVE HELD CLOSED BY FUSION OF THERMAL PLUG.
SPECIFY INITIAL OPENING PRESSURE
TYPE "BB" ASSEMBLY
FLAME ARRESTER WITH THERMAL OPERATED SHUT OFF VALVE - REQUIRES MANUAL RESETTING TO RESUME OPERATION.
SPRING
FIG. 332
FROM TANK
"VAREC" FIG. 332 SHUT OFF VALVE SEE DRAWING C-32-A1
THERMAL OPERATED. VALVE HELD OPEN IN NORMAL OPERATION - CLOSES BY FUSION OF THERMAL PLUG.

Varec Flame Trap Layout

Treatment Trailer Tackles Telephone Pole!

A letter from Jeff Corydon, dated Bryson City, N. C., conveys sad news about his well-known % Proportioneers % trailer, as follows:

"Unhitched while leaving Roanoke, Va., at 55 mph. en route to Galveston, Texas, AWWA-trailer tackles telephone pole while car and Jeff Corydon continue unscratched on right side of highway.

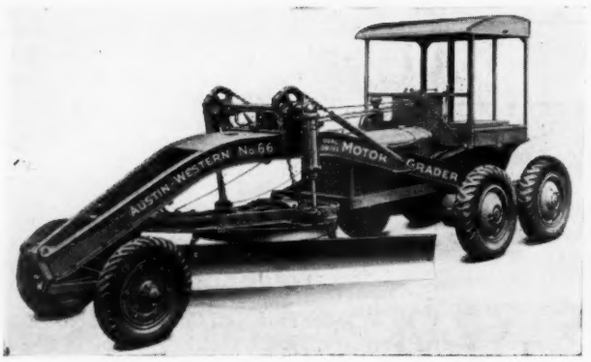
"Photos show ruination of lab-on-wheels. Only the ice box was unbroken and backed by this blessing continued on to Bryson City to make a service call

The wreck

and am roofless, tailless and halfsideless, dragging back to the East to study trailer hitches before trying again. Will also reread Clarence Budington Kelland's Satevepost story entitled 'How's Your Hitch.'

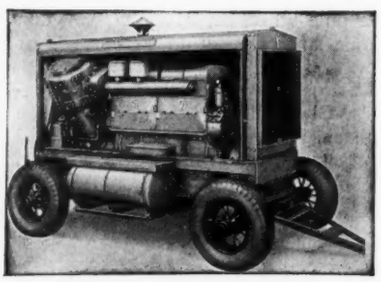
"The 42 kinds of cigarettes thumbtacked to walls of trailer and the stack of papers, drawings, etc., which littered the highway took hours of picking up exercises.

"Photos for your news department, though neverletitbesaid we would deliberately perform this as a publicity stunt, with the 1937 Treatment Trailer. Regards to you."

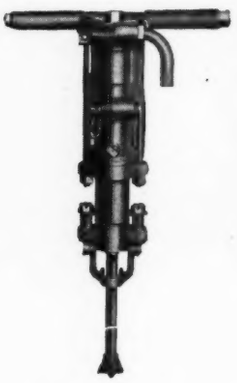


New Austin "66" grader has Buda diesel engine as standard equipment. Information, power curves, full data, etc., in Bulletin 869B, sent on request to Buda Co., Harvey, Ill.

Department of Sanitation of New York City recently purchased this Mack tank truck, with capacity of 1,920 gallons of gasoline, to service other trucks.

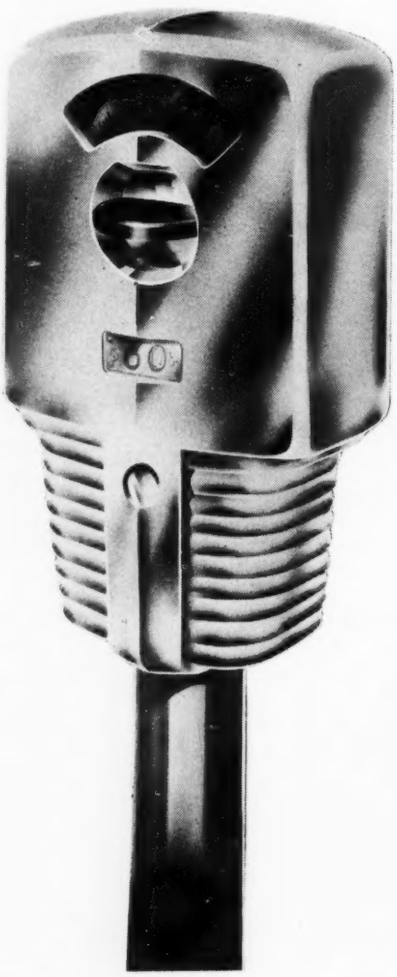


The portable type diesel driven compressor of the Chicago Pneumatic Tool Company.



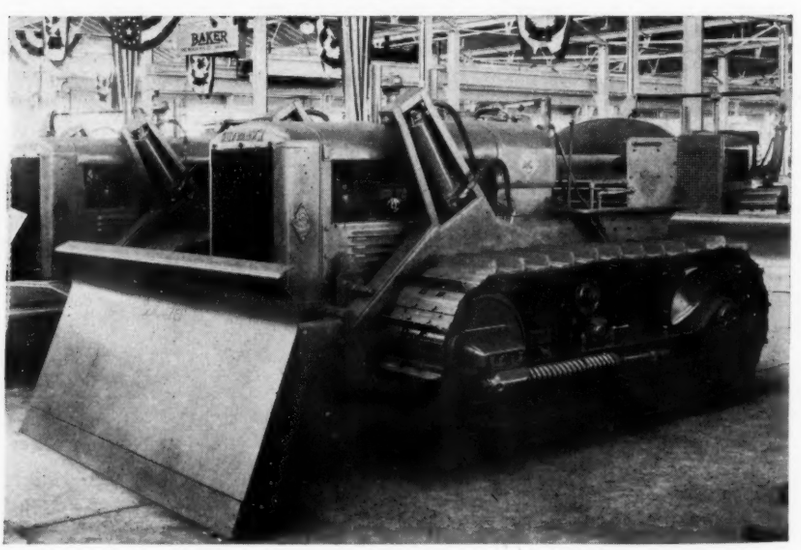
New Ingersoll Rand jackhammer. Ask for Form 2337

Studebaker Dump Truck on Street Rebuilding, South Bend, Indiana.



The Karpark Meter helps to regulate and control parking and to speed up traffic. Graybar Electric Co., Inc., New York, N. Y.

Above, Dodge dump truck.



Allis-Chalmers "S-O" controlled oil ignition tractor with a Baker bulldozer.

Readers' Service Department

These booklets are FREE to readers of PUBLIC WORKS.

CONTINUED FROM PAGE 64

Pipe, Cast Iron

406. Data on cast iron pipe for water works systems, in sizes from 1¼ to 84 inches, including information on useful life, flow data, dimensions, etc., Thos. F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Pipe, 2-inch Cast Iron

407. The new McWane 2" cast iron pipe in 18-foot lengths has innumerable uses in water and sewage work. Send for the new McWane bulletin describing this pipe, the various joints used, and other details about it. McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Large Cast Iron

408. Handy cast iron pipe and fittings catalog contains A.W.W.A. and A.G.I. standard specifications for a wide variety of cast iron pipe specialties, both bell and spigot and flanged; also dimensions Lynchburg Foundry Co., Lynchburg, Va.

Pipe, Steel

409. A very complete, 60 page, illustrated bulletin on spiral welded pipe including lots of useful engineering information, hydraulic data, flow charts, specifications, etc., issued by American Rolling Mill Co., Pipe Sales Div., 1101 Curtis St., Middletown, Ohio.

Pipe Forms

411. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe Joints

413. New folder describes in detail a new type of pipe joint—the Dresser Compression Coupling, Style 65, which is compact and self contained, makes a permanently tight joint under all conditions and is installed on plain end pipe in a few seconds with only one tool, a wrench. Get your copy today. S. R. Dresser Mfg. Co., Bradford, Pa.

Pipe Joint Compound

414. A new bulletin has recently been issued giving full details concerning Tegul Mineralead, a quick-sealing, trouble-free compound for bell and spigot joints which permits immediate closing of the trenches. Write The Atlas Mineral Products Co. of Pa., Mertztown, Pa.

Taste and Odor Control

417. How, when, and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Div., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

Pumps and Well Water Systems

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

Protective Pipe Coating

422. Coal-tar Pitch Enamels for exterior and interior linings for steel water lines; highly resistant to water absorption, soil acids and alkalis. Technical specifications for materials and their application will be sent on request. The Barrett Company, 40 Rector St., New York, N. Y.

Pumping Engines

424. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Run-off and Stream-Flow

425. Excellent booklet describes and illustrates the latest types of instruments for measuring run-off, both from small areas for storm sewer design, and from large areas for determining water shed yield. Sent promptly by Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

428. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Avenue, Chicago, Ill.

Snow Fighting

349. "V Type Sno-Plows for Every Size Motor Truck" describes and illustrates all features of the Frink V type plow, including the new power hydraulic control as well as the earlier types of lifting devices. Also describes and illustrates 14 styles of leveling wings and the different attachments which may be used in connection with them. Just issued by Carl H. Frink, Mfr., Clayton, N. Y.

350. One-Way Speed Sno-Plows are illustrated and described in a 4-page catalog. Features, specifications, methods of attaching. Carl H. Frink, Clayton, N. Y.

351. New catalog, with previously unpublished pictures of snow fighting, and data on 1937-38 V, One-Way and Reversible plows and Wings, with improved power hydraulic controls. Parsons Co., Newton, Ia.

352. Snow Plows for 1¼ to 2-ton Trucks, Bulletin 1698; snow plows for 3-ton trucks, Bulletin 1699. Cover straight-blade reversibles, one-way and V plows. Controls; specifications. Austin-Western Road Machinery Co., Aurora, Ill.

353. 36-page booklet on snow plows, with data on use, descriptions and specifications. Covers V, One-Way and Reversible plows for trucks; separate booklet covers tractor plows. Ask for Booklet 592. Baker Mfg. Co., Springfield, Ill.

355. "Make Icy Pavements Safe With Rock Salt" is an authoritative booklet describing one of the most effective and economical methods of winter ice control. International Salt Co., Scranton, Pa.

357. Hydraulic Controls provide "fingertouch" ease in handling snow plows, and are simpler, quicker and permit higher operating speeds. For information on installation on present plows, ask for Bulletins 36-12 and 36-13. Vickers, Inc., 1412 Oakman Blvd., Detroit, Mich.

358. Snow Fence. Folder describes Beach fence and gives information on details of construction, location, etc. Beach Mfg. Co., Charlotte, Mich.

359. "Avoid Winter Tie-Ups." A folder describes various types of thawing equipment and their uses. Hauck Mfg. Co., 124-136 Tenth St., Brooklyn, N. Y.

361. "New Snow Power." A booklet describes Case heavy-duty, four-speed special wheel tractors for snow removal work, grading, ditch cleaning, shoulder shaping and medium construction. J. I. Case Co., Racine, Wisc.

362. The Sargent Handbook for 1938 contains sound, practical and valuable information on how to plow snow, and the types of plows, wings, etc., best suited for the various conditions of work. 86 pages. Sent on request. Maine Steel, Inc., South Portland, Maine.

363. The Linn tractor, a combination motor truck and crawler tractor is described and its many uses for snow fighting, road maintenance and construction outlined in a folder. Linn Mfg. Co., Morris, N. Y.

Setting and Testing Equipment for Water Meters

430. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

Rainfall Measurement

432. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons, Baltimore, Md.

Screens

435. Water Screen Book No. 1252, describes traveling water intake screens and gives complete technical information about them. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.

Sludge Incineration

440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

Swimming Pool Equipment

444. Filters, chlorination, underwater lights and other supplies for swimming pools are very thoroughly described in literature and folders. Plans and layouts. Everson Filter Co., 214 West Huron St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Treatment

448. New 31-page catalog covers complete conveying, screening and reduction machinery for water purification and sewage treatment; describes and illustrates the design features of Jeffrey self-cleaning bar screen, combined screen and grinder, sewage screenings grinder, grit washer, conveyor type and positive discharge sludge collectors and green garbage grinder—includes installation views. Catalog 615, Jeffrey Manufacturing Co., Columbus, Ohio.

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

453. How to avoid sludge and scum troubles in settling tanks explained in detail in Book No. 1542—has excellent drawings and photographs, also specifications. Most important are the carefully prepared capacity tables. Link-Belt Co., 307 N. Michigan Ave., Chicago, Illinois.

454. Full information regarding their newest equipment for sewage treatment and water purification will be sent on request by The Dorr Co., 570 Lexington Ave., New York, N. Y.

Water Works Operating Practices

490. This is a reprint of two excellent papers by F. E. Stuart. One outlines a number of filtration and field practices of value. The other presents a lot of kinks the author has picked up in visits to more than 1,000 water works plants. Sent free by Activated Alum Corp., Curtis Bay, Baltimore, Md.

Drawing Supplies

495. Perspective and Isometric paper, graph paper, tracing paper, blue print hangers, automatic (irregular) curves, adjustable curves, multi-purpose charting papers, etc. Write for illustrated bulletin. Wade Instrument Co., 2246-PW, Brooklyn Station, Cleveland, Ohio.

For the Engineer's Library

Brief reviews of the latest books, booklets and catalogs for the public works engineer.

Aluminum Paint Manual:

A complete text of 97 pages that gives reliable information on the subject. Chapter headings are: Characteristics of aluminum paint; pigment for aluminum paint; vehicles, with descriptions; testing of aluminum paints; methods of application as brushing, spraying, dipping, flow-coating, roller-coating and burnishing; and detail directions for use on wood, steel, galvanized iron, tin plate, heated surfaces, aluminum, brick, concrete, stucco, plaster, wallboard, composition roofing, asphalt and tar surfaces and canvas. Interior painting, specifications and recommendations for handling and storing are included. This will be sent on request to PUBLIC WORKS, 310 East 45th St., N. Y.

Mechanized Pavements:

A remarkably fine book for the highway engineer, especially having to do with concrete pavements. Modestly listed as a catalog, it is more nearly a text of why and how expansion and contraction joints. The use and function of joints are covered by Clifford Older; load transmission methods are discussed and various combinations of materials are described. Details are illustrated in working drawings and specifications given. It is impossible to give here even a resume of all the valuable information presented in the 76 pages of this text, but the highway engineer and contractor will find much of value and interest. The "Deflectoguide" is a brand new idea and worth considering. Book will be sent on request to Hayes Robertson, Highway Steel Products Co., Chicago Heights, Ill.

Air Release Valve Data:

At high points in pipe lines air collects and blocks the flow, either wholly or partly. The symptoms are often obscure. But if you are worrying over poor delivery from a pipe line, check it over for high points that are not equipped with air relief valves. Make a tap, and see if you don't get some air out. If you do, install one of the valves described in a folder that has been issued by Simplex Valve & Meter Co., Philadelphia, Pa., and you'll have permanent relief.

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136 N. 12TH ST. PHILADELPHIA, PA.

Also, there is good dope on what to do and how to do it. Ask for Bulletin 58.

Chemical Feeding:

Here is plenty of information on chemical feeding equipment, along with installation drawings and pictures of many actual jobs. We take it these have been picked up by "Jeff" Corydon on his many trips with his well-known trailer. In the 12 pages of this booklet are packed an astonishing amount of data and advice. Sent on request. Proportioneers, 9 Codding St., Providence, R. I.

The Venturi Meter:

The venturi meter, one of the most helpful inventions in the water works field, has been celebrating a golden anniversary, so that this excellent booklet is timely. It covers the characteristics and applications of the venturi tube and the venturi meter, lists dimensions, with minimum and maximum flows, and shows the application to registering, indicating and recording equipment, including the long distance Chronoflo. Builders Iron Foundry, Providence, R. I. Ask for Bulletin 293, which will be sent on request.

Porous Mediums:

Selecting a proper porous medium for filtration, for aeration or other purposes should be based on a knowledge of the characteristics of these materials. This 16-page booklet gives a lot of information of value to the sewerage or waterworks engineer; curves for air flows are shown and installations. Norton Co., Worcester, Mass.

Welded Piping:

Includes methods for light and standard pipe; layouts, drawings and specifications; welded joints and fittings; shop and field fabrication; and piping erection. Linde Air Products Co., New York, N. Y.

Waterproofing:

A loose-leaf catalog has been prepared by Presstite Engineering Co., St. Louis, Mo., which covers the use of Enamelite, an asphaltic mastic for many kinds of waterproofing, including dams, sea walls, bridge abutments, retaining walls, etc. Detailed instructions for use are given.

Preventing Welding Fires:

A pocket-size 16-page booklet. Tells how fires may start, where to do the work, rules for preventing fires, and putting out fires. The rules for prevention are clear and simple and are illustrated with sketches. Linde Air Products Co., New York, N. Y.

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